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DEPARTMENT OF DEFENSE
HANDBOOK

AIRCRAFT MAINTENANCE FACILITIES

THIS HANDBOOK IS FOR GUIDANCE ONLY. DO NOT CITE THIS DOCUMENT AS A REQUIREMENT.

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ABSTRACT

This handbook is provided as guidance for aircraft maintenance facilities covered by Category Codes 211 and 212 for military real property. It is intended for use by experienced architects and engineers. The contents include design data for buildings and shop areas to provide aircraft maintenance, including airframes, aircraft engines, aircraft weapons systems, avionics systems, air-launched guided missiles, and other related aircraft equipment.

FOREWORD

This handbook has been developed from an evaluation of facilities in the shore establishment, from surveys of the availability of new materials and construction methods, and from selection of the best design practices of the Naval Facilities Engineering Command (NAVFACENGCOM), other Government agencies, and the private sector. This handbook was prepared using, to the maximum extent feasible, national professional society, association, and institute standards. Deviations from this criteria, in the planning, engineering, design, and construction of Naval shore facilities, cannot be made without prior approval of NAVFACENGCOM Criteria Office.

Design cannot remain static any more than the functions it serves or the technologies it uses. Accordingly, recommendations for improvement are encouraged and should be furnished to Commander, Naval Facilities Engineering Command, Criteria Office, 1510 Gilbert Street, Norfolk, VA 23511-2699; telephone (757) 322-4204, facsimile (757) 322-4416.

DO NOT USE THIS HANDBOOK AS A REFERENCED DOCUMENT FOR PROCUREMENT OF FACILITIES CONSTRUCTION. IT IS TO BE USED IN THE PURCHASE OF FACILITIES ENGINEERING STUDIES AND DESIGN (FINAL PLANS, SPECIFICATIONS, AND COST ESTIMATES). DO NOT REFERENCE IT IN MILITARY OR FEDERAL SPECIFICATIONS OR OTHER PROCUREMENT DOCUMENTS.

MAINTENANCE FACILITIES CRITERIA MANUALS

Criteria Manual	Title	Preparing Activity
MIL-HDBK-1028/1	Aircraft Maintenance Facilities	NAVFAC
MIL-HDBK-1028/3	Maintenance Facilities for Ammunition, Explosives, and Toxins	NFESC
DM-28.4	General Maintenance Facilities	EFA CHES
MIL-HDBK-1028/5	Environmental Control - Design of Clean Rooms	NFESC
MIL-HDBK-1028/6	Aircraft Fixed Point Utility Systems	SOUTHDIV
MIL-HDBK-1028/8	Pest Control Facilities	NAVFAC

AIRCRAFT MAINTENANCE FACILITIES

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Section 1: INTRODUCTION

1.1 Scope. This handbook contains criteria for the design of Navy and Marine Corps aircraft maintenance facilities, except most Naval Aviation Depots (NADEPs), to support the Naval Aviation Maintenance Program in accordance with Chief of Naval Operations (OPNAV), OPNAVINST 4790.2, The Naval Aviation Maintenance Program (NAMP).

1.2 Cancellation. This handbook cancels and supersedes MIL-HDBK-1028/1B of 15 January 1997.

1.3 Other Design Considerations. Aircraft maintenance officers of shore activities are to be closely consulted throughout the entire design effort of any project related to the construction, repair, or modernization of aircraft organizational and intermediate facilities (refer to Volume 1 of OPNAVINST 4790.2). This is to ensure that technical requirements for specific aircraft maintenance and testing procedures as outlined in Naval Air (NAVAIR) technical manuals receive proper consideration in the design of these facilities.

1.4 Facility Plates. When definitive drawings are revised, they are converted to facility plates to be included in the handbook covering that type of facility. The facility plate number is the category code number, and the sheets required to present the information are numbered sequentially.

1.5 Definitive Drawings. Definitive drawings, where they exist for aircraft maintenance facilities covered by this handbook, are contained in NAVFAC P-272, Part 3, Definitive Designs for Marine Corps Facilities, and are an integral part of the Naval Facilities Engineering Command (NAVFACENGCOM) design program. Definitive drawings are listed in numerical sequence by the Navy category code number assigned to that facility. Use definitive drawings associated with this handbook as the basis for design, unless prior clearance for change is obtained from NAVFACENGCOM. The architectural treatment, materials, framing, and construction may vary. Special design features for a particular aircraft system will be provided by the system facilities requirement document of the NAVAIR Facilities Branch.

1.6 Planning Criteria. Naval aviation is a highly dynamic field and maintenance concepts depend increasingly on state-of-the-art computer technology. Planning factors in NAVFAC P-80, Facility Planning Criteria for Navy and Marine Corps Shore Installations, and design criteria included in the NAVFAC criteria manuals are guides that must be used with specific weapons system facilities requirement documents (FRD) to design a fully usable aviation facility. NAVAIR Facilities Management Division, Fleet Support Branch, works with the weapons systems developers to identify unique aviation facility requirements. NAVAIR engineering personnel are available during design and construction to provide specialized expertise to NAVFAC or to arrange for weapons system manufacturers' representatives to attend design reviews if requested by NAVFAC Engineering Field Divisions (EFDs) or Engineering Field Activities (EFAs) or aviation facility users.

1.7 Building Functions. Naval and Marine Corps shore aircraft maintenance complexes consist of buildings and mobile facilities (MFs). In these complexes are facilities and shops for the repair and maintenance of aircraft and component parts. The Aircraft Intermediate Maintenance Department (AIMD) officer complex normally includes the following shops (buildings):

a) AIMD Administration,

b) Airframes Shop,

c) Engine Maintenance,

d) Avionics Shop,

e) Aviation Armament Shop (see facility plates),

f) Aviation Life Support Systems,

g) Engine Test Cells,

h) Battery Shops, and

i) Ground Support Equipment (GSE) Shop.

While the construction of MFs is not covered in this handbook, their interrelated use and connection to the buildings should be a considered part of each design.

1.8 Organizational Communications. An intercommunicating two-way voice system, with use restricted to maintenance and material management (3M), should be provided. The system will connect the AIMD officer, assistant officer, and production control office with each squadron maintenance control office in the aircraft maintenance hangar and the production control offices in the:

a) Airframes Shop,

b) Avionics Shop,

c) Engine Maintenance Shop,

d) Ground Support Equipment Shop,

e) Aviation Armaments Shop, and

f) Aviation Life Support Systems Shop.

NOTE: The AIMD will be located in the station administration building, a separate maintenance administration building, or one of the shop buildings (preferably the Avionics Shop). For maintenance hangars' organizational communications, refer to par. 2.6.

1.9 Energy Conservation. Energy conservation should be a major consideration in the design of building envelopes, mechanical systems, and electrical systems for aircraft maintenance facilities. Refer to MIL-HDBK1003/3, Heating, Ventilating, Air Conditioning, and Dehumidifying Systems. Each building envelope should be insulated to provide the minimum heat transmission ("U") factors practical to meet energy budgets.

1.10 Environmental Concerns. The maintenance facilities should meet applicable pollution abatement criteria. For applicable discharge criteria, NAVFACENGCOM Criteria Office and the cognizant EFD or EFA should be consulted. Refer to MIL-HDBK-1005/8, Domestic Wastewater Control, MIL-HDBK-1005/9, Industrial and Oily Wastewater Control, and NAVFAC DM-1.03, Architectural Acoustics.

It is essential that, as part of the preliminary studies, consideration be given to water conservation and source control, including the possibility of substantial alteration of the process or plant operation to reduce pollutant loading. The greater the volume of wastewater to be treated and the greater the amount of contaminant to be removed or destroyed, the higher are the capital, labor, and material costs required. As a result, it is often economical to eliminate or reduce the quantity of waste at its source prior to treatment or in place of treatment. Several possible techniques exist including process change, material recovery, segregation, and water reuse. Sometimes, with only partial purification, spent water can be reused, once or several times, in the industrial process. Water unsuitable for direct reuse may be serviceable for a different purpose, in which quality requirements are less restrictive.

Often, there are a number of alternatives that can achieve the desired result. Therefore, a major objective of the preliminary studies should be to determine what combinations of actions will be the most cost effective and technically and operationally feasible.

1.11 Building Protection. The building structure of all aircraft maintenance facilities, including corners of interior partitions and exterior walls, doors, structural members, etc., should be protected from damage by vehicles and moving loads by the installation of concretefilled pipe guards, bumpers, railings, corner guards, and similar protective features.

1.12 Loading Dock Ramp Protection. Each facility requiring a loading dock ramp should be provided side-edge protection in accordance with Section 1910.23c of Public Law 29 Code of Federal Regulations, Section 1910, Occupational Safety and Health Act Standards Manual.

1.13 Fire Protection. Fire protection for aircraft maintenance facilities should be provided in accordance with MIL-HDBK-1008C, Fire Protection for Facilities Engineering, Design, and Construction; National Fire Protection Association (NFPA) 409, Aircraft Hangars; and Air Force Regulation (AFR)-88-15, Criteria and Standards for Air Force Construction, as applicable to the specific building.

1.14 Restrictions on the Use of Uncoated Aluminum

1.14.1 Seacoast. Aluminum roofing and siding should not be specified for structures located within 10 miles (3.05 kilometers (km)) of the seacoast, due to salt deposition or incrustation from inshore winds and salt-laden atmosphere.

1.14.2 Exterior and Interior. The restrictions for the use of preformed (corrugated) aluminum roofing and siding are applicable also to sandwich panel and flat sheet construction of unprotected (uncoated) aluminum and to ribbed aluminum extrusions. Consideration should also be given to the corrosion of aluminum surfaces on the interior of structures due to salt deposits from salt-laden air.

1.14.3 Incompatible Materials. Surfaces of incompatible metals; wet, green, or damp wood; wood treated with incompatible preservatives; masonry; and concrete should be isolated from direct contact with the aluminum by a heavy coat of alkali-resistant paint or by other approved means.

1.14.4 Coated Metal. Coated metal roofing and siding should be in accordance with Naval Facilities Guide Specification (NFGS)-07410, Metal Roof and Wall Panels.

Section 2: MAINTENANCE HANGAR

2.1 Function. Design the maintenance hangar to provide weather-protected shelter for the servicing and repair of Navy and Marine Corps aircraft, emergency shelter for operable aircraft, and headquarters and office space for squadron personnel. This type of hangar should be modular in nature, consisting of hangar (OH) space, shop and equipment (O1 level) spaces, and administrative (O2 level) spaces required to support the aircraft and the mission of the particular squadron or activity occupying the hangar at any particular time. The optimum hangar design should be the support function of one or two complete squadrons per hangar module, dependent on the type of aircraft involved, as defined in NAVFAC P-80. By making the hangars modular, the station has the option of building them as single units or stringing the modules together into one long hangar complex. The use of a standard configuration gives the station flexibility in hangar assignments or in future changes in base loading.

2.2 Location. The siting of maintenance hangars should be correlated to minimize distance between the hangar and parked aircraft while maximizing the efficiency of operations, scope of visibility and verbal communications. Factors that must be emphasized include building orientation to runways and taxiways, modular expansion, line shack locations, Intermediate Maintenance Activity (IMA) relationship, Aircraft Ground Support Equipment shop and Ground Support Equipment Holding Shed location, and unique climatic conditions. Care must also be taken to site the hangar in accordance with the requirements of NAVFAC P-80.3, Airfield Safety Clearances and NAVFAC P-971, Airfield and Heliport Planning and Design. It should not be sited within any runway safety zone or in a location where it might extend into any imaginary surface.

2.3 Architectural and Structural Requirements. The maintenance hangar should be a modular building designed to allow flexibility and economical expansion by internal rearrangement and/or additional maintenance modules. Modules should be designed to meet necessary flexibility and maintenance requirements in organization, strength, quantity, type of aircraft, and level of maintenance. There are two types of modular maintenance hangars, as indicated in the facility

plates. A Type I maintenance hangar is principally designed for carrier aircraft, but is adaptable to meet requirements for rotary wing and various types of smaller aircraft. The O1 level and O2 level spaces in this type of hangar are configured for a typical strike fighter squadron, two carrier airborne early warning squadrons, or a helicopter antisubmarine warfare squadron. A Type II maintenance hangar is principally designed for a patrol squadron, but is adaptable for larger the aerial refueling and transport aircraft. The O1 level and O2 level spaces are designed to accommodate a typical marine aerial refueling and transport squadron or Navy patrol squadron. Adequate and secure storage space should be provided throughout the maintenance hangar as required by the offices and shops occupying the facility. Storage areas must comply with NFPA 409 requirement for minimum 1-hour separation. For larger special mission aircraft, design hangars for specific requirements.

2.3.1 Structure. The modular structure of the maintenance hangar should be a steel frame with a cantilever roof truss system. Use of a column free front cantilever roof structure over the hangar bays allows for maximum maneuverability of aircraft within the hangar as well as flexibility for future changes in base loading. Hangar expansion can be accommodated by construction of additional hangar modules attached to existing hangars without the need for columns at the front or ends of the hangar bay areas. Use of an alternative roof structure requires prior approval from NAVFACENGCOM Criteria Office with the endorsement of the major claimant. The hangar should be designed to use prefabricated components to the maximum extent practicable. Weathering steel, if considered, should not be used where exposed to recurrent wetting by salt water. In areas where weathering steel is acceptable, proper detailing and use of materials should be a requirement to prevent staining of adjacent building components. Design the overall structural suspension system for wind uplift conditions peculiar to the site. Provide a bridge crane in the OH space of each maintenance hangar module supporting helicopters, propeller driven aircraft, or the C-9, V-22, or AV-8 aircraft. In the future, H-53 will normally be a type II hangar. If NAVAIR headquarters makes special exception for housing an H-53 in a special modified type I hangar, the minimum hook clearance must be 8.2 meters (27 feet). Do not use bridge cranes in maintenance hangars supporting other types of aircraft except in

specialized instances approved by NAVFACENGCOM or when specifically required by the FRD. Requirements for the bridge crane, motor, and controls are given in par. 2.8. In all cases, the hangar roof support structure should be designed to accommodate the loading from overhead bridge crane described in par. 2.8.1.

a) Wind load on main building wind force resisting system should be determined on the following two conditions:

(1) Hangar doors fully open for winds up to 96.6 kph (60 mph).

(2) Hangar doors closed for winds above 96.6 kph (60 mph) up to the maximum wind velocity for the geographic area. Refer to American Society of Civil Engineers (ASCE) 7, Minimum Design Loads for Buildings and Other Structures.

b) Cantilevered hangars have historically proven challenging to erect correctly. It is imperative that full disclosure of the design assumptions and limits be given on the contract drawings.

c) This should include all loading conditions at all phases of the structure’s life, from skeleton erection through installation of finishes and accessories (i.e., “dead load”). Loading conditions should also include temperature effects, including sun on exterior steel and shaded interior steel differential temperatures, in the stress and deflection information. Drawing information should also include any anticipated shoring (methods and points) and should account for anticipated temperature effects from differential solar heating (e.g., on long sun-exposed steel such as masts, forestays and backstays compared to shaded steel such as roof trusses. Designer should consider local climate conditions when selecting the final differential temperature range). A minimum of 50-degree temperature difference is recommended. Refer to ASCE 7 for appropriate loading combinations to include self-straining forces. Critical member stresses probably will not be determined by temperature differential forces; however, experience has shown that roof truss deflection can be significantly affected by routine changes in ambient temperature. Design stresses (or member loads) and deflections

should be shown on the design drawings for all such cases. Camber should be required to equal or exceed all dead load deflections.

d) The cantilever truss roof design should incorporate a deflection primary and secondary adjustment method. The design drawings and specifications should require the Contractor to “level” the truss tips (above the hangar door) after all roof and supported materials have been installed into their final positions. It is suggested that the primary adjustment system be installed in the forestay (and the backstay if necessary), but other systems are permissible. To level the truss tips, the Contractor should be required to survey the roof truss system to ensure the structural system is performing as the designer intended. The Contractor’s survey should be done during stable atmospheric conditions (night, early morning, or a cloudy calm day). The designer of record should review and approve the survey information prior to installing the hangar doors. Primary adjustments of more than 1 inch vertical movement, if required to level the truss, should be approved by the designer of record. Secondary or cosmetic adjustments up to 1 inch of correction can be accomplished by shimming or milling structural members below the truss tip under the supervision of the Contracting Officer.

e) Hangar door guide systems are normally sized to allow total roof truss live load deflection not to exceed 10 inches. The designer of record should be responsible for coordinating the total anticipated roof deflection with several potential door guide manufacturers to ensure the most economical overall system is selected.

f) Designers are cautioned to ensure that the basic structural frame must be “statically determinate” during the adjustment phase (to avoid introduction of large and often unpredictable stresses into a constrained system).

g) Provide a means to “lock in” the final adjusted configuration once the system has been leveled. If high strength bolts are used, ensure that they are fully tensioned.

2.3.2 Roof Systems. The roof system, due to large surface area and proximity to operating aircraft, should be carefully

selected. Expansion joints, insulation vents, and traffic pads or walkways should be provided where applicable. Insulation should be provided as required in par. 1.9. On built-up roofs, the design should preclude carrying gravel or slag aggregate from the roof surface by high winds or drainage to any area where aircraft operate. The color of roof surfaces should be as described in par. 2.3.8. Provide gutter and outrigger downspouts at the front of the hangar. Provide snow guards at the front of the hangar in areas subject to heavy snowfall. Provide access from O2 level spaces to the low roof over the O1 and O2 spaces, and exterior access to the high roof over the OH space through a secured access panel or hatch, to prohibit unauthorized passage. . Built-up roofing, insulation, and moisture protection should conform to the applicable guide specifications listed in MIL-HDBK-1000/1, Engineering and Design Criteria and Documentation for Navy Facilities.

a) Use one of the following systems:

(1) Metal roof deck with rigid insulation, smooth surface built-up roof system or mineral surface modified bitumen roof system.

(2) Composite metal deck and lightweights concrete engineered roof system with smooth surface built-up roof system or mineral surface modified bitumen roof system. Composite deck supplier should be responsible for connection of lightweight material to deck.

(3) Other types of roof systems based on cost and energy savings can be considered.

b) Select the most suitable roof systems from the following criteria:

(1) Very low slope (minimum of 6 mm per 305 mm (1/2 inch per foot)). Where roof slopes are 6 mm per 305 mm (1/2 inch per foot), decks should be stiff enough to prevent ponding, and a built-up roof should be smooth surfaced.

(2) Sloped roofs (25.4 mm per 305 mm (1 inch per foot) or greater). Roofing membrane, insulation, and moisture

protection should be used only on roofs with a slope of 25.4 mm per 305 mm (1 inch per foot) or greater.

(3) Pitched roofs. Insulated metal roof panels should be used. Panels should be pre-engineered or field-fabricated and filled with blanket or rigid insulation with insulation blocks over purlins.

2.3.3 Wall Systems. Walls and partitions should be non-load bearing. The O1 and O2 structure should be used to help balance the weight of the cantilever, roof structure, and hangar doors. The O1 and O2 structure should be built as an integral part of the backside of the cantilever bridge structure. The OH structure is supported by the cantilever trusses, vice columns and sidewalls.

2.3.3.1 Exterior Walls. Side walls of the OH space should be insulated hollow concrete masonry units sized in accordance with American Society for Testing and Materials (ASTM) C 90, Loadbearing Concrete Masonry Units or reinforced concrete walls to a height of 3.05 meters (10 feet) above the hangar deck. Type and amount of insulation should be based on local climatic conditions. Above this height, use preformed (corrugated), protected-metal panels, backed with rigid or blanket insulation, except that translucent reinforced fiberglass panels should be used to increase natural lighting. Insulated panels should be capable of withstanding water effects of deluge discharge. The installation of translucent wall panels is contingent upon an energy analysis for areas having 3000 heating degree-days or better. It must be shown that the quantity of lighting-related energy saved exceeds the quantity of heating-related energy lost through the uninsulated, translucent panels. Factors that should be considered other than degree-days are light transmission and the coefficient of heat transmission (U factor). In areas of seismic activity, seismic codes should govern for this wall construction. Aluminum panels may be used only in accordance with par. 1.14. Exterior walls of the O1/O2 level spaces should be concrete masonry units, including wall abutting OH space, with voids filled with insulation. Windows to the exterior of the O1/O2 level spaces should be operable thermopane units. Any framing and connecting paneling between windows should be insulated storefront units.

2.3.3.2 Interior Partitions. The interior partitions should be metal studs with vinyl-covered gypsum wallboard facing over insulation (when essential to minimize noise transmission between spaces). Surface materials of interior partitions should meet the requirements in MIL-HDBK-1008C. All O1 and O2 level spaces, except soundproofed spaces, should be designed to provide the preferred noise criteria (PNC) levels given in Table 3-9 of NAVFAC DM 1.03. Treat administrative spaces requiring soundproofing with above-ceiling barriers and design spaces to provide a PNC of 25. Provide above-ceiling barriers for spaces that require locked doors. Windows from the O2 level space to the OH space should be 6-mm (1/4 inch) thick, fixed, tempered wire glass in steel frames and should be provided with sound-attenuating drapes. Provide tempered wire glass windows, to the extent allowed by the various codes, in swinging fire doors between shops, control areas, and the OH area. In all O1 and O2 level administrative and shop spaces, provide a system for hanging charts and schedules on available wall surfaces. A high impact acrylic/polyvinyl chloride (PVC) sheet wall covering with a minimum thickness of 2.4 mm (.093 inch) should be applied to all wall surfaces in the O1 spaces to a minimum height of 1.2 meters (4 feet). Corners will be protected with a similar material, also to a minimum height of 1.2 meters (4 feet).

2.3.4 Floors. Personnel and administrative space floors should be designed for a uniform live floor load of 488 kg/m^2 (100 psf). They should be covered with tile or sheet flooring per NFGS 09651, Resilient Tile Flooring, NFGS 09655, Resilient Sheet Flooring, or NFGS 09656, Resilient Sheet Flooring (Institutional). Floors in command and executive level offices and conference rooms should be covered with carpet or carpet tile in accordance with NFGS 09680, Carpet or NFGS 09685, Carpet Tile. Floors in the avionics and electrical shops should have the floor covered by insulated matting meeting the requirements of ASTM D 178, Rubber Insulating Matting. A subfloor electrical distribution system through metal ducts and built-in junction boxes through the concrete top layer should be provided on a modular basis.

Maintenance Hangar floors should meet the following criteria:

a) Design the primary loading areas of the hangar floors in accordance with criteria in MIL-HDBK-1021/2, General Concepts for Airfield Pavement Design and MIL-HDBK-1021/4, Rigid Pavement Design for Airfields. Hangar trench drains should be ductile iron or steel manufactured to withstand a minimum working load of 100,000 loads(250 psi). AFFF floor nozzles and supporting framework embedded in trench drain grating should be designed for 36,000 pounds distributed over area of nozzle surface.

b) Hangar floors should be sloped towards hangar doors and drains.

c) For new construction, use of thin epoxy polyurethane (5 to 7 mils) reflective floor coatings is prohibited due to maintenance problems. For new concrete floors, use a white dry shake system consisting of cement, pigment, special hardening admixtures, sand, and gravel as the topping to achieve increased lighting levels without increased energy consumption. The white dry shake surface hardener should consist of specially selected cement plasticizer, and water-reducing admixtures formulated and processed under stringent quality control by the manufacturer. For questions on the dry shake floor applications, contact LANTDIV, Code 4062 or the NAVFAC Criteria Office.

d) For maintenance and repair of existing floors, moderate film thickness white reflective polyurethane (16 to 30 mils) coatings have performed best in laboratory conditions. Prior to application of a repair coating, limited surface preparation is recommended to remove obvious signs of contaminants such as oils, fuels, and hydraulic fluids. Patch repairs of concrete spalls and cracks also are recommended.

e) To provide access in event of fire, injury, or other problem, a 3.05-meter (10 feet) wide emergency vehicle access lane from doors to rear of each module or partial module is required. The lane should be placed as closely to the center of each module as possible with aircraft parking restrictions. Paint fire lanes on the floor after white reflective dry shake coating cures.

f) Floor area in OH space and the 01 / 02 area should be essentially on the same plane. The 01 / 02 space is well

ventilated and suitably isolated from the OH space. Aircraft normally housed in Navy/Marine Corps hangars is considered to be essentially purged of fuel. Equipment used in the hangar OH space within 18 inches of the floor should be Class I, Division 2 hazardous rating in accordance with NFPA 70, National Electrical Code. Permanent electrical fixtures should be placed 18 inches above finished floor where possible. Refer to par. 2.5 for additional electrical requirements.

2.3.5 Ceilings. Administrative and personnel spaces on both the O1 and O2 level should be provided with a noncombustible suspended acoustical ceiling. Toilet, locker, and cleaning gear room ceilings should be water resistant. Ceilings in O1 level shop spaces may be of open construction if acoustical material is applied to reduce reflected noise and noise radiation into the O2 level spaces above.

2.3.6 Doors and Door Controls. Doors and door controls should meet the criteria defined in pars. 2.3.6.1 through 2.3.6.5. Design hangar doors in accordance with components and cladding, Wind Pressure coefficients determined in accordance with ASCE 7. Designers should consider the full operating range of the roof structure and wind uplift to design door guide system.

2.3.6.1 Hangar Doors. Hangar doors should be a series of insulated, horizontal sliding leaves with protected, preformed (corrugated) metal or sheet-steel siding. Each sliding door leaf should be supported on hardened wheels rolling on recessed rails with guide rails at the top of the door. Hangar door rail support system should provide for surface drainage. Intermittent drainage to hangar trench drains should be at 10 feet 0 inch maximum.

Thresholds should be designed to minimize dirt accumulation or ice buildup at rails. Leaves of the door should be insulated and should be provided with waterproof weather stripping and emergency personnel exits as required by NFPA 101, Life Safety Code. The hangar doors should be hand-crank operated or electric motor operated. For electric motor operation, drives may operate leaves independently or in groups of three with drives on the end leaves and a pickup mechanism for the center leaf. The use of a cable system for the pickup mechanism should not be considered due to the extra maintenance

required to keep the cable system in good operating condition. Each drive unit should have a release mechanism, and the doors should be provided with a means of movement in the event of power failure. The normal mode of operation is an electric drive and the minimum speed of door travel should be 0.3 m/s (60 fpm).

Control of the doors should be by momentary contact type push buttons located near the leading edge of the door and limit switches on each door leaf. Safety devices should be installed to prevent injury to personnel and damage to equipment by moving door sections. If personnel access doors are provided in the hangar door leaves, an interlock should be installed that will prevent operation of the hangar door leaves when the personnel access doors are open and will halt the hangar door leaves in the event a personnel access door is opened while the hangar door leaves are in operation. An alarm should sound in conjunction with safety warning beacons when doors are in motion. Sliding steel hangar doors should be in accordance with NFGS 08342, Steel Sliding Hangar Doors.

2.3.6.2 Personnel Doors. Personnel doors between the hangar (OH) and shop spaces (O1 level) should be 3/4-hour, C-rated, self-closing, insulated fire doors. Hold-open devices should not be permitted.

2.3.6.3 Interior Personnel Doors. Interior personnel doors to stairways should be self-closing, swinging doors. Hold-open devices should not be permitted. Refer to the appropriate guide specifications listed in MIL-HDBK-1000/1.

2.3.6.4 Overhead Doors. Overhead doors between the hangar (OH) and shop spaces (O1 level) should be 3/4-hour, C-rated.

2.3.6.5 Other Doors. For other doors, provide stock industrial doors in accordance with the appropriate guide specifications listed in MIL-HDBK-1000/1. Provide one self-closing, insulated personnel exit door through the middle leaf of hangar door group and in each sidewall of the hangar (OH space). No hold-open device should be permitted. A vehicle access door must be provided either within or adjacent to the hangar aircraft access doors.

In the O1/O2 level spaces, use heavy-duty commercial grade door and window hardware (Grade 1). Use 1000 series, Grade 1, door and window hardware where extremely heavy traffic is anticipated. Use security Grade 2 locksets. Vaults for the protection of classified material require X0-7 electronic door lock and access control system in accordance with DOD 5200.1R, Information Security Program Regulation.

2.3.7 Soundproofing. The spaces requiring soundproofing, as shown in the facility plates, should be sound proofed to reduce the noise level from the outside to a PNC of 25. Refer to Army TM 5-805-4, Noise and Vibration Control.

2.3.8 Surface Treatment. The chemical properties of materials and finishes for exterior surfaces should have the highest resistance to the effects of weather and salt-corrosive atmosphere.

To prevent mirror like reflections from building surfaces to aircraft in flight, roofs and other external surfaces should have a specular reflectance compatible with the location of the building on the airfield.

If the building is so located that glare may be an operational hazard, the critical surfaces of that building should have a light reflectance of not more than 10, measured at an angle of 85 degrees in accordance with ASTM D 523, Specular Gloss.

2.3.9 Exterior Pavement. Exterior paved areas should include aircraft and vehicle access and non-organizational parking. Aircraft pavement should be in accordance with NAVFAC P-80.3, NAVFAC P-971, MIL-HDBK-1021/2, and MIL-HDBK-1021/4. Vehicle access and parking should be in accordance with facility plates in this handbook; NAVFAC DM-5.4, Pavements; and MIL-HDBK-1190, Facility Planning and Design Guide.

2.4 Mechanical Requirements. The maintenance hangar should be designed to meet the criteria set forth in pars. 2.4.1 through 2.4.6.

2.4.1 Heating. Heating should be provided in accordance with MIL-HDBK-1003/3 and as follows:

a) Design for an infiltration rate of two air changes per hour in the OH area. This rate is dependent upon the installation of nylon brush insulation seals on the hangar sliding doors.

b) A switch activated by opening the hangar doors should override the space thermostat to stop the heating equipment in the OH area. Provide a minimum temperature thermostat field set at 1 degree C (34 degrees F) to override the heating deactivation switch during door-open periods of subfreezing ambient temperatures. After the doors are closed, the room thermostat should assume control. Heating system recovery time should be 30 minutes after the doors are closed.

c) A snow-melting system at the hangar door tracks should be installed when outside design temperature is plus -4 degrees C (+25 degrees F) or lower and historical snow accumulation data supports the requirement.

d) An under floor heating system should be provided for the OH area when outside design temperature is below -23 degrees C (-10 degrees F).

e) The automatic thermostatic control should meet the requirements of MIL-HDBK-1003/3.

f) Each module in the OH area should be a separate heating zone.

g) See the facility plates for design conditions.

h) Consider the installation of Naval Facilities Engineering Service Center (NFESC) cold jet destratifiers based on an economic analysis.

2.4.2 Ventilation. Ventilation should be provided in accordance with MIL-HDBK-1003/3 and as follows:

a) Toxic fumes and combustible vapor that generate in work areas should be exhausted directly to the outside. The Airframes, Corrosion Control and Electric Shops are likely

producers of toxic fumes. These shops should always be provided with exhaust ventilation to the outside.

b) If fuel systems maintenance is performed in the OH spaces, a system for purging the fuel line and the tanks should be provided. A fuel vapor exhaust system should also be provided.

2.4.3 Air Conditioning. Air conditioning should be provided in accordance MIL-HDBK-1003/3 and MIL-HDBK-1190. Automatic thermostatic control should be provided, and equipment should be shut down when not required for cooling. Air conditioning is not required in the general OH space.

2.4.4 Plumbing. Plumbing should be provided in accordance with NAVFAC DM 3.01 Plumbing Systems, and should provide:

a) Toilet and shower facilities for both sexes on both the O1 and O2 levels.

b) An adequate storm drainage system,

c) Trench drains with sufficient laterals for aeration and easy cleanout of oil or other residue,

d) Emergency shower/eyewash fixtures and floor drains, as shown in the facility plates and conforming to ANSI Z358.1, Emergency Eyewash and Shower Equipment,

e) An oil/water separator for trench drains,

f) Storm drains located a minimum of 305 mm (12 inches) from the hangar access door rails, and

g) Aqueous film-forming foam (AFFF)/sprinkler discharge collection/retention system when required by environmental regulations.

h) Hazardous materials are used in the aircraft maintenance process. Floor drains in the OH space and shop spaces should be tied to either the station industrial sewer or to a collection system that will capture and hold these

materials for proper disposal. The design will comply with all applicable environmental codes.

2.4.5 Compressed Air. Compressed air should be provided for all O1 level shop spaces at 0.018 m^3/s (40 cfm) and 862 kPa (125 psi) and for hangar (OH) space as required by MIL-HDBK-1028/6, Aircraft Fixed Point Utility Systems for hangar service points.

2.4.6 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with Army TM 5-805-4.

2.5 Electrical Requirements. Electrical equipment installations should comply with NFPA 70. Electrical systems should be provided in accordance with the electrical engineering criteria manuals and pars. 2.5.1 through 2.5.4 of this handbook.

2.5.1 Hangar (OH) Space. The maintenance hangar (OH) space should be designed to meet the criteria set forth in pars. 2.5.1.1 and 2.5.1.2.

Electrical equipment in the hangar (OH) space should be waterproof, NEMA Type 4 (minimum rating) when deluge sprinkler protection is provided to prevent equipment damage in the event of testing or accidental discharge of the deluge system.

2.5.1.1 Hazardous Zones. Areas in high bay space should be classified as hazardous or non-hazardous in accordance with the NFPA 70, and electrical installations should meet applicable requirements. Where possible, electrical installations will not be located in hazardous zones.

2.5.1.2 Power Service Points. MIL-HDBK-1028/6 identifies the various types, the capacity, and the location and installation requirements of electrical power to be provided at the power service points. Aircraft power service points will be positioned on the back wall of the hangar. The power service points will provide:

a) Three phase, 115/200V, 400 Hz, (as required by aircraft type)

b) Three phase, 480 V, 60 Hz, with (Class L) receptacles for GSE

c) Single phase, 120 V, 60 Hz, ground fault interrupt duplex utility outlets

d) 28 V direct current (as required by aircraft type)

e) External aircraft power provided by the power service points must be within the voltage and frequency tolerances specified for aircraft type. The flexible power cable to the aircraft must be adequately sized to meet the specified aircraft loading (amperage) requirement. Refer to MIL-HDBK-1004/5, 400 Hertz Medium-Voltage Conversion/ Distribution and Low-Voltage Utilization Systems for 400 Hz power requirements and to par. 2.5.4 for OH space power grounding requirements for aircraft maintenance.

2.5.2 O1/O2 Level Spaces. Power outlets should be provided for shop tools and at shop bench locations.

Grounded convenience outlets at 60 Hz, 120 V, 20 ampere capacity should be provided throughout the O1/O2 level administrative, personnel, and shop spaces as required by NFPA 70. Provide ground fault interrupt (GFI) receptacles in locations required by NFPA 70.

2.5.3 Lighting. Lighting for the maintenance hangar should be designed to meet the criteria set forth in pars. 2.5.3.1 and 2.5.3.2.

2.5.3.1 Interior Lighting. Interior lighting in the hangar (OH) space should be an energy-efficient type, such as high-pressure sodium vapor. Other interior lighting should be fluorescent. Lighting intensities should be designed in accordance with MIL-HDBK-1190 and should take into consideration the reflectance of wall and floor surfaces, especially in hangar (OH) spaces.

2.5.3.2 Exterior Lighting. Exterior lighting should use high-pressure sodium lamps where practical and should be in accordance with MIL-HDBK-1004/4, Electrical Utilization Systems. Provide a photoelectric control switch for exterior lighting.

2.5.4 Grounding. The maintenance hangar should be provided with flush floor ground receptacles, each with a 3/4-inch (19 mm) diameter ground rod, on 7.3 m (24 foot) centers across the centerline of the OH space. Resistance to ground should be 25 ohms maximum. Ground receptacles should be provided together with No. 4 AWG bare copper in or below the hangar floor. See Figure 1 for typical static grounding details.

2.5.5 Lightning Protection. Lightning protection should be provided in accordance with NAVSEA OP-5, Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation and Shipping. NAVSEA OP-5 applies only to weapons handling operations. We do not need a Faraday Shield around the building. Refer to NFPA 780, Installation of Lightning Protection Systems.

2.6 Organizational Communications. The maintenance hangar should be provided with internal communications as described in pars. 2.6.1 through 2.6.4 (refer to par. 1.8 for other organizational communications requirements).

2.6.1 3M Communications (Maintenance and Material Management). An intercommunications system, with use restricted to aircraft maintenance and material operations only, should be provided. This system should provide two-way communications from line operations shacks outside the hangar to and between all rooms in the O1 level space except passages, locker and toilet rooms, and mechanical equipment room. The necessary raceway should be provided in new building construction, with provisions in some instances for interconnection with other buildings.

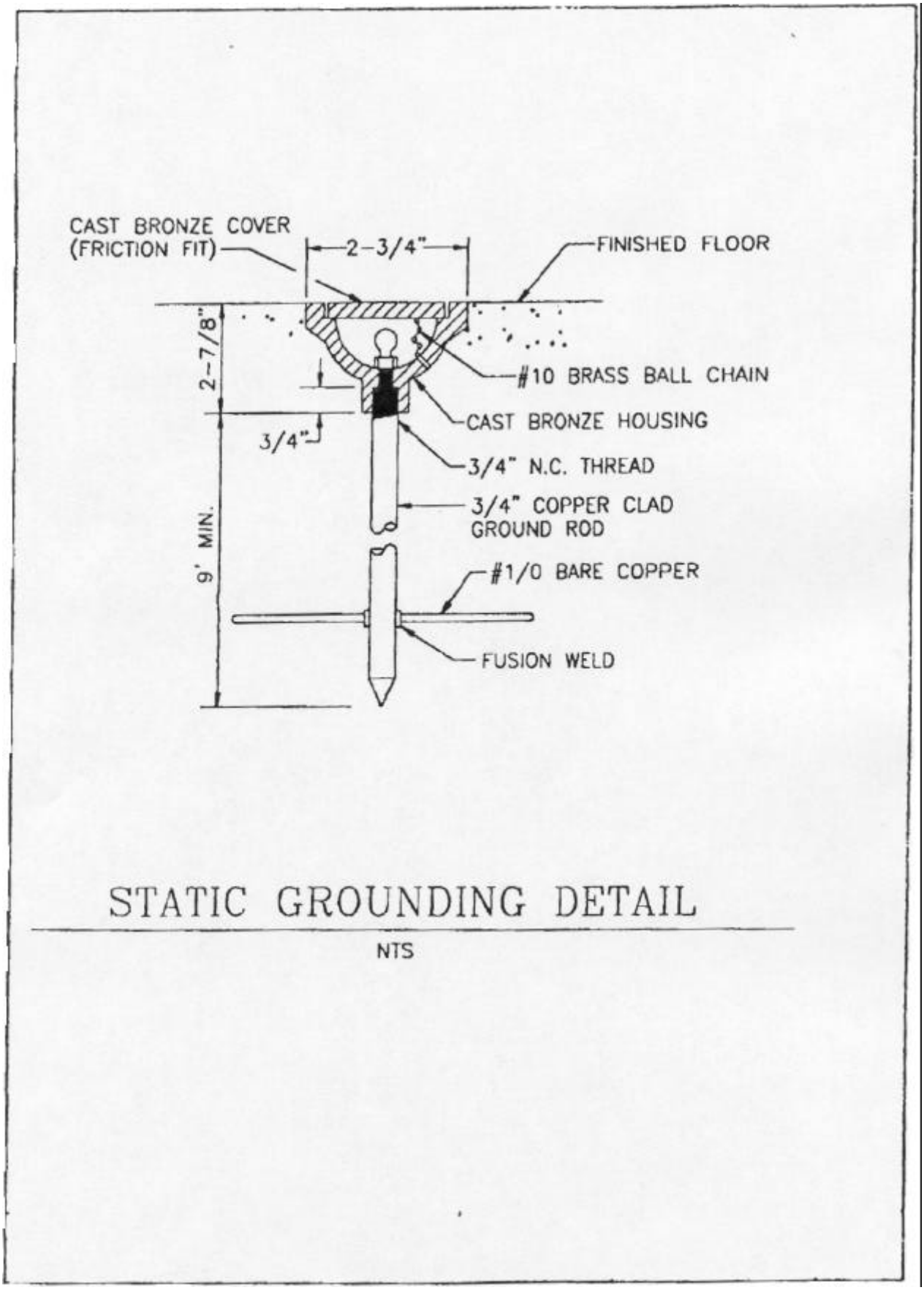


Figure 1
Static Grounding Detail

2.6.2 Intercommunications System. An intercommunications system should be provided to allow two-way communications between:

a) Rooms in the O2 level space except passages, locker and toilet rooms, and storage rooms;

b) Department heads and the commanding officer and executive officers of the squadron;

c) Officers' ready room and maintenance control; and

d) Administration office and maintenance administration.

2.6.3 Public Address System. A public address system should be provided to reach interior and exterior work areas and the aircraft parking apron.

2.6.4 Telecommunications Service Requirements for Voice, Data, and Video. For telecommunication, refer to MIL-HDBK 1012/3, Telecommunications Premises Distribution Planning, Design, and Estimating and EIA/TIA Standards Fiber Optic Service Preferred.

2.7 Security. The maintenance hangar should contain secure storage vaults with walls and floor not less than 8 inch reinforced concrete. Roof or ceiling should be determined by structural requirements but not less than 8 inches in accordance with DOD 5200.1R. Refer to MIL-HDBK-1013/1, Design Guidelines for Physical Security of Facilities, for additional criteria.

2.8 Weight-Handling Equipment. When required in accordance with par. 2.3.1, the maintenance hangar (OH) space should contain overhead bridge cranes and jib cranes in accordance with criteria in NAVFAC DM 38.01, Weight Handling Equipment, and pars. 2.8.1 and 2.8.2.

2.8.1 Bridge Cranes. Overhead bridge cranes should have an electric motorized bridge, trolley, and hoist. One 4540 kg (5 ton) capacity crane should be used per hangar module, with the bridge designed to travel the full width of the module. The bridge should span 12.2 meters (40 feet), with the center line of the bridge located 9.1 meters (30 feet) from the rear

bulkhead. Trolley and bridge should be capable of operating at a slow speed of 0.076 to 0.102 m/s (15 to 20 ft/min) for positioning loads and at a high speed for moving loads of 0.305 m/s (60 ft/min); the hoist should be capable of operating at a slow speed of 0.015 to 0.02 m/s (3 to 4 ft/min) and at a high speed of 0.06 m/s (12 ft/min). Refer to NFGS 14637, Cranes, Overhead Electric, Underrunning (Under 20,000 pounds).

2.8.1.1 Motor and Controls. Bridge, trolley, and hoist controls should provide for two-speed reversing of a two-speed, squirrel-cage motor. The controls should be equipped with reduced voltage starting for the motors. Controls should be operable from the floor.

2.8.1.2 Hook Height. The hook height for bridge cranes should be as required to raise engines and transmissions clear of aircraft. Minimum hook clearance height (measured from the hangar floor to the hook at full retraction) for hangars housing H-53E aircraft should be 8.2 meters (27 feet). All others should have a minimum ceiling height of 7.6 meters (25 feet) for the Type I module and 11.6 meters (38 feet) for the Type II module.

2.9 Aircraft Service Utility Location. When locating aircraft service utilities inside the hangar (OH) space they should be located on the rear bulkhead only. Use of utility pits in hangar floors is specifically prohibited. Utility pits in hangar floors are unsatisfactory for the following reasons:

a) Litter can block the drains and water will "stand."

b) If an aircraft wheel sits on the pit cover, the utilities in that pit are inaccessible.

c) The basic purpose for the utility pits is not achieved; the utility lines will still be on the floor and can be tripped over, run over, etc.

d) The cost of locating utilities in pits is higher than locating utilities on the rear bulkhead.

2.10 Fire Protection. The fire protection design should be in accordance with MIL-HDBK-1008C. Water supplies for aircraft hangars should also be in accordance with MIL-HDBK-1008C.

2.10.1 Floor Drainage. Provide apron and hangar floor drainage in accordance with NFPA 409. Floor drains in aircraft storage and service areas should be trench-type drains designed with sufficient capacity to prevent buildup of flammable/combustible liquids and water over the drain inlet when all fire protection systems and hose streams are discharging at the design rate. The trench must be of adequate size to contain a 6 inch pipe (approximately) with fittings for the ATFF trench system. The width and depth of all trench drains should be calculated accordingly. In addition, the trench drains should have sufficient room to accommodate mounting the floor-level AFFF solution system piping and nozzles where provided. Floor drains should be in accordance with appropriate facility plates and Figure 2, Trench Drain Detail, for Aircraft Hangars and Figure 3, Trench Plate Arrangement.

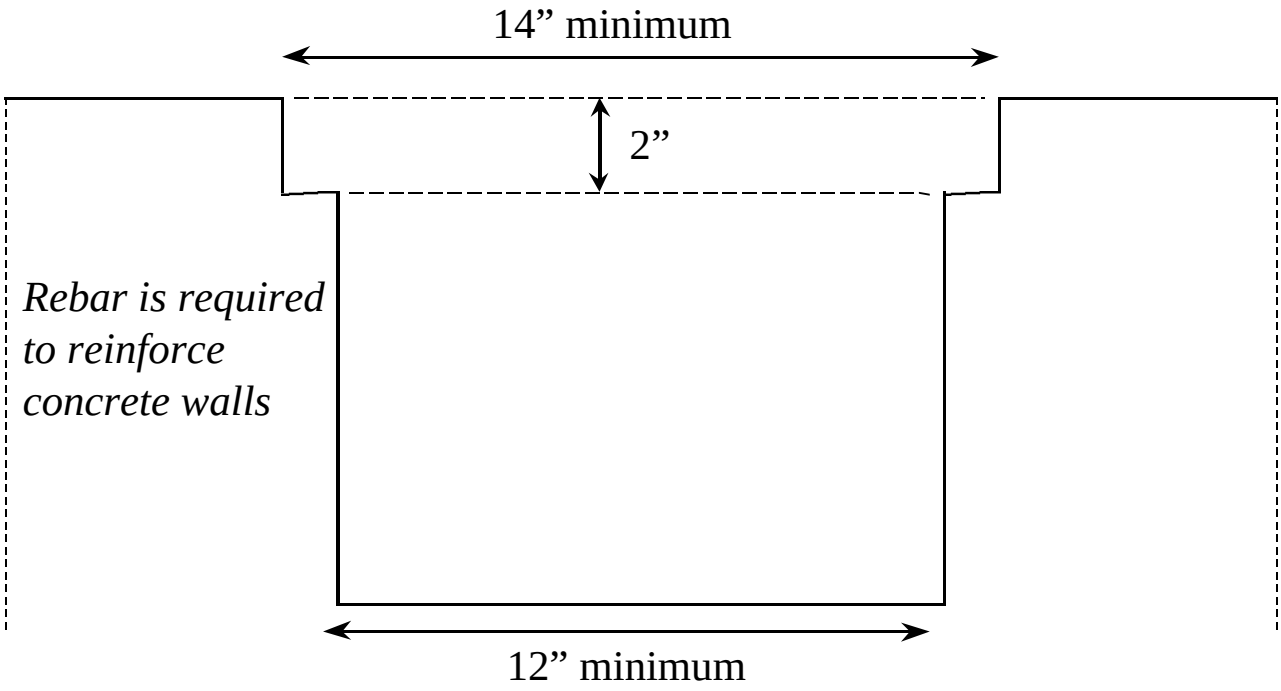


Figure 2
Trench Drain Detail

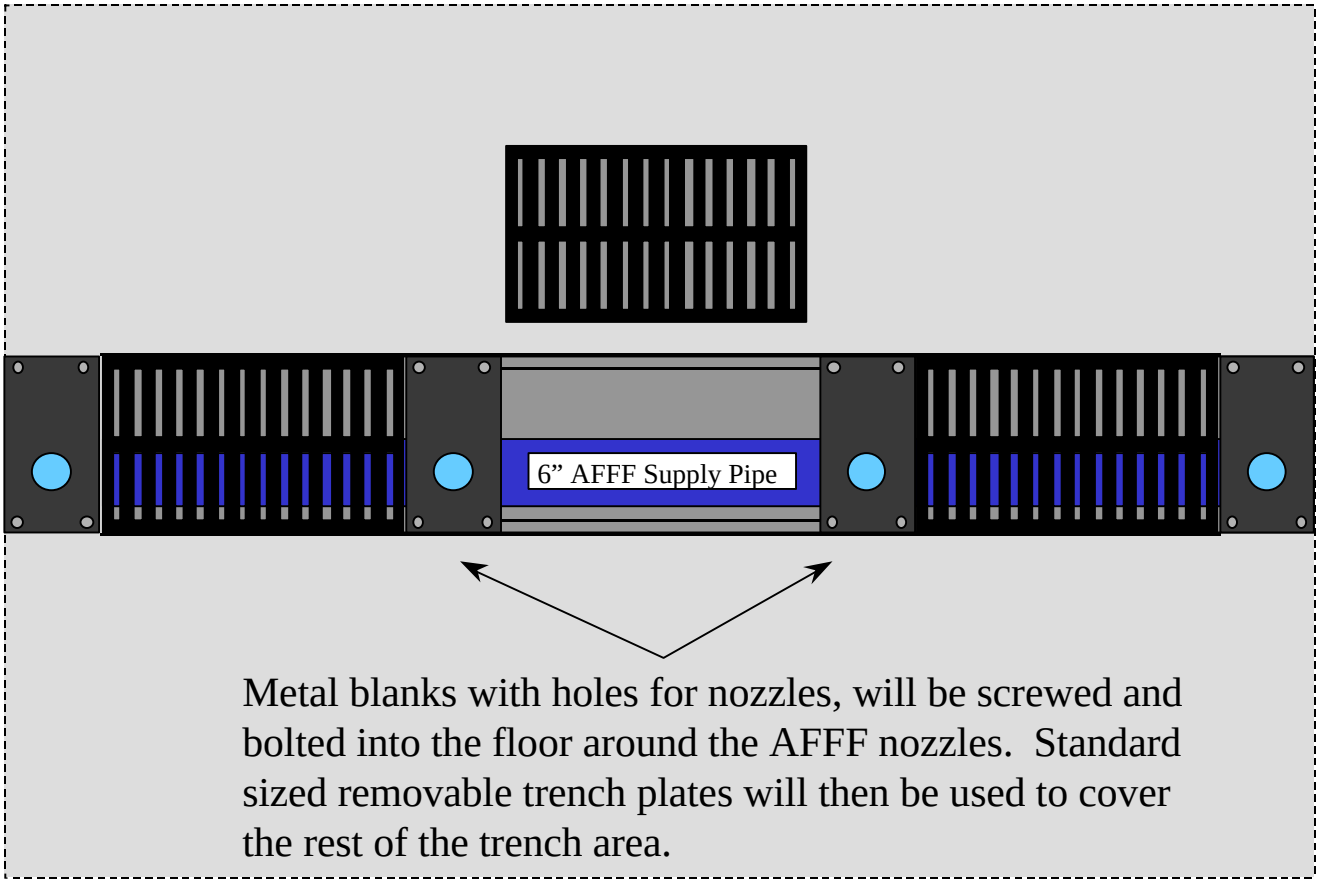


Figure 3
Trench Plate Arrangement

2.10.2 Draft Curtains. Provide non-combustible draft curtains to separate the hangar bay roof area into individual sections not exceeding 1,394 square meters (15,000 square feet) in area. Draft curtains should be constructed and installed in accordance with NFPA 409.

2.10.3 O1/O2 Level Spaces. Automatic, wet-pipe sprinkler system should be provided in areas of the hangar facility not requiring AFFF sprinkler protection.

2.10.4 Fire Alarm Systems. Provide manual and automatic fire alarm system reporting to the base-wide system.

Section 3: CORROSION CONTROL HANGAR

3.1 Function. The corrosion control hangar should be designed to provide space and equipment for the corrosion control processing of aircraft. This corrosion control process can be performed at either a depot level or organizational and intermediate (O/I) level facility as defined in NAVAIR Technical Manual NA01-1A-509, Aircraft Weapons Systems Cleaning and Corrosion Control. Facilities designed for depot level maintenance should be based on de-paint/re-paint of the entire aircraft. Facilities designed for O/I level maintenance should be based on repair of damaged paint systems and de-paint/re-paint of components only. This does not include de-painting by plastic media blasting (PMB) equipment. Functions performed in the corrosion control hangar include: deicing, limited detergent washing and rinsing, paint stripping, corrosion removal, protective coating application and painting, and finish curing and drying. Refer to NAVAIR Technical Manual NA01-1A-509 for detailed functions performed in this facility.

3.2 Location. The corrosion control hangar should be located in proximity to the maintenance hangars and as close as possible to an aircraft washrack. Access between the corrosion control hangar, the maintenance hangar, and the aircraft washrack is required. The prevailing wind should be considered in orienting the building in relation to aprons, taxiways, and parking, to allow for exhaust air dispersal over areas not affected by solvent fumes. Care must also be taken to site the hangar in accordance with the requirements of NAVFAC P-80.3 and NAVFAC P-971. It should not be sited within any runway safety zone or in a location where it might extend into any imaginary surface.

3.3 Architectural and Structural Requirements. Two types of depot level corrosion control hangars are indicated in the facility plates. The Type A corrosion control hangar is designed for carrier aircraft and other small aircraft, and the Type B corrosion control hangar is designed for land-based transport or patrol aircraft. Because both construction and operating costs increase as the volume of the hangar bay increases, depot level corrosion control hangars for aircraft larger than those accommodated by the Type B hangar and O/I level corrosion control hangars should be individually designed

around the specific dimensions of the aircraft concerned. With the exception of the following special requirements, the corrosion control hangar should be designed using the general architectural and structural requirements for maintenance hangars set forth in par. 2.3.

a) The size of the various aircraft scheduled to use the facility will determine the hangar bay dimensions. Size the bay to accommodate fixed-wing aircraft with wings unfolded, and helicopters and V-22 with rotors in place and unfolded unless it has been determined that aircraft surfaces are accessible with the wings/rotors folded. The following minimum clearances are required to allow proper access for work platforms and to minimize paint overspray on hangar walls and ceilings:

(1) Top of aircraft (vertical fin, radome, rotor head, tail rotor) to underside of ceiling - 1.53 meters (5 feet);

(2) Nose of aircraft to hangar door - 3.05 meters (10 feet);

(3) Tail of aircraft or tail rotor to exhaust target wall - 3.05 meters (10 feet); and

(4) Horizontal and vertical clearance from aircraft to open front door - 1.53 meters (5 feet).

In addition to these clearances, the depth of the door and exhaust plenum (T) is required to properly size the hangar bay. The equation T = 1/5H defines this depth where H is the height of the aircraft at its highest point plus 1.53 meters (5 feet). Note that the depth (T) does not include the thickness of the structure of the door or the filter media.

b) The number of hangar bays for each site should be based on an analysis of aircraft types, production schedules, hours required for each corrosion control operation, and number of work shifts. Refer to NAVFAC P-80 for criteria to develop the required quantity of bays. If the work load includes a mix of large and small aircraft, a moveable partition at the center of the bay can be used. Bays in which stripping, blasting, or

grinding are done will be separate from spaces where painting is done.

c) Ancillary space requirements will vary based on facility requirements. Paint mixing, paint storage, waste paint area, bead blast rooms, gear equipment and tools, office, non-destructive inspection, strip/rinse, paint spray, and dry storage spaces should be provided. The size of the rooms is based on the workload. Provide exit doors to the outside for rooms designated for storing or mixing chemicals or paints. Provide a depressed floor slab or door sills with ramps to contain spills. Spaces in which stripping, blasting, or grinding are done will be separate from spaces where painting is done.

d) Provide storage space for dry filters. Provide stairs for personnel and a roof mounted jib crane for materials transport to the roof.

e) Provide a loading dock.

f) Provide a trench drain at the doorway between the hangar bays and the ancillary spaces.

g) Provide a connection to the station Industrial Waste Treatment System or to a collection tank from all drains. The corrosion control process generates large amounts of water that could potentially hold solid or liquid paint residue or other solvents and wastes.

h) Provide space for work on composite helicopter rotor blades if applicable.

i) An overhead bridge crane is not required in the hangar bays.

j) Locate utilities on the side walls. Use of utility pits in hangar floors is prohibited.

k) Design for the aircraft fully loaded with fuel.

3.3.1 Structure. The hangar structure should be steel frame with open-web, steel-joist roof. The structure for areas

adjacent to the hangar area should be load-bearing, insulated, concrete-masonry unit construction with open-web, steel-joist roof. The strip/rinse room should be equipped with a 1,814 kg (2-ton) overhead monorail. The requirements of NFPA 33, Spray Application Using Flammable or Combustible Materials, should be incorporated into the design.

3.3.2 Walls. With the exception of the following criteria, walls should be in accordance with par. 2.3.3:

a) Exterior walls of the hangar area should be a steel frame and girts framing system with insulated preformed (corrugated) metal siding. Exterior walls of the other areas should be insulated concrete masonry units.

b) The hangar area should be separated from paint mixing and storage rooms, chemical mixing room, cleaning gear and storage room, corridor, and toilet and locker areas, by 2-hour fire-rated walls.

c) Hangar bays in multiple bay structures should be separated by 3-hour fire-rated walls.

d) Provide seals at doors, wall penetrations, and building joints in the hangar bays and ancillary spaces to ensure airtight performance to maintain pressure differentials and prevent contamination of the air in the hangar bay.

3.3.3 Roofs. Roofs should meet the criteria defined in par. 2.3.2.

3.3.4 Floors. Floors should meet the following criteria.

a) The hangar area floor should be designed in accordance with criteria in MIL-HDBK-1021/2 and MIL-HDBK-1021/4.

b) Other floors should be designed in accordance with the criteria manual series on structural engineering, and should be provided with resilient tile or sheet floor coverings, as specified in NFGS-09651, NFGS-09655, or NFGS-09656.

c) For new construction, use of a thin epoxy white reflective floor coatings is prohibited. Include a white dry

shake floor hardener as the topping on the floor slab in the hangar area. Refer to par. 2.3.4.c) & 2.3.4.d) for new construction and maintenance policy respectively.

3.3.5 Ceilings. Aircraft bays and paint storage, mixing, and spray areas should have water-resistant gypsum ceilings. Provide a 1-hour fire-rated ceiling in paint bays. Suspended acoustical ceilings should be provided for corridors, toilets, locker rooms, and offices. Suspended acoustical ceiling panels in shower areas should have vinyl plastic surfaces. The strip/rinse room ceiling should be of corrosion-resistant, perforated metal.

3.3.6 Doors and Door Controls. Doors and controls should be as described in pars. 3.3.6.1 through 3.3.6.3.

3.3.6.1 Hangar Doors. Hangar doors should be a specialized, insulated, hangar type with swinging leaves. These doors should serve as an insulated supply air plenum when closed. Provide perforated plates in the supply air plenum, one stationary and one adjustable, which allow for balancing to achieve laminar flow. Use 19 mm (3/4-inch) to 25 mm (1-inch) holes spaced to give approximately 50 percent free area. Plates are to be 18 gauge galvanized steel. Each door leaf should be a motor-operated unit with a release mechanism, and the doors should be provided with a means of movement in the event of a power failure. Adequate safety devices should be installed to prevent injury to personnel and damage to equipment due to moving door sections. Thresholds should be designed to minimize dirt accumulation and ice buildup.

3.3.6.2 Personnel Doors. Personnel doors between the hangar area and paint and chemical mixing rooms and the corridor should be 1-1/2-hour B-rated, self-closing fire doors. Hold-open devices should not be permitted.

3.3.6.3 Other Doors. Other doors should be as described in par. 2.3.6.5. Provide self-closing, insulated personnel exit doors from each hangar bay. No hold-open devices should be permitted. Special precautions should be taken to seal doors between hangar areas and exterior or adjacent spaces. A vehicle access door should be provided either within or adjacent to the hangar aircraft access doors.

3.3.7 Building Insulation. Building walls, roofs, and floors should meet the criteria defined in par. 1.9.

3.3.8 Surface Treatment. In addition to the requirements of par. 2.3.8, the side walls, the inside of hangar doors, and the ceiling of the hangar area should be provided with a light color, smooth surface such as white enameled metal panels.

3.3.9 Exterior Pavement. Exterior paved areas include aircraft and vehicle access and non organizational parking. Aircraft pavement should be in accordance with MIL-HDBK-1021/2 and MIL-HDBK-1021/4. Vehicle access and parking should be in accordance with facility plates in this handbook and NAVFAC DM-5.4.

3.4 Mechanical Requirements. The design of the corrosion control hangar should meet the mechanical requirement set forth in pars. 3.4.1 through 3.4.5.

3.4.1 Heating and Air Conditioning. Heating and air conditioning should be provided in accordance with MIL-HDBK-1003/3 and as follows:

a) Based on an economic analysis, consideration should be given to providing a system for the recovery of heat from the exhaust air.

b) The required hangar bay design heating temperature will normally be between 24 degrees C (70 degrees F) and 32 degrees C (90 degrees F) with a relative humidity between 50 and 70 percent. Some activities may require higher temperatures to accelerate curing cycles.

Exact requirements for each site must be determined based on materials and production requirements. The hangar area should be equipped with an automatic cutoff of the heating system when the main hangar doors are open.

Minimum temperature thermostat should be set at 1 degree C (34 degrees F) to override the heating deactivation switch during door-open periods of subfreezing ambient temperatures.

The recovery time for the heating system should be 30 minutes after door closure.

c) Provide a snow-melting system at the hangar door tracks when the outside design temperature is -4 degrees C (+25 degrees F) or lower and when historical snow data supports the requirement.

d) Refer to the facility plates for design conditions in other hangar spaces.

e) Each bay in the OH area should be a separate heating zone.

f) Heating should be suitable for operation in the vapor hazard condition in the hangar bay, flammable storage/mixing areas, and paint equipment cleaning spaces.

3.4.2 Ventilation for Control of Air Contaminants and Flammable Vapors. Ventilation should be provided in accordance with MIL-HDBK-1003/17, Industrial Ventilation Systems, and NFPA 33. The ventilation system for the hangar area should furnish 100 percent filtered outside air at a horizontal laminar flow velocity of 0.51 m/s (75 fpm) across the entire cross-section area of the hangar bays for chemical stripping/painting operations for worker safety and overspray control. Provide 0.25 m/s (50 fpm) airflow velocity during the drying cycle and de-paint by grinding operations, and a minimum of 6 air changes per hour for other procedures. Fans should be direct drive or vane axial for supply and exhaust. Provide demister in the supply system. Interlock the fans and the compressors so that the compressors cannot operate when the fans are inoperative. Interlock the fans and the fire protection system so that the fans cannot operate when the fire protection system is inoperative. The ventilation system should maintain a slightly positive static pressure of 1.25 mm (0.05 in.) water gage between the hangar area and the exterior to avoid infiltration of contaminants into the hangar space which can affect painting operations. Maintain a slightly higher pressure in the adjacent ancillary spaces and overhead ceiling spaces than in the hangar area to keep the hazardous fumes given off by stripping agents from infiltrating into these spaces. Ventilate the space above

the hangar bay ceiling to provide a nonhazardous space for light fixtures.

Note: The NAVFACENGCOM Criteria Office and NFESC, Naval Occupational Safety and Health (NAVOSH) Branch recently reduced design flow rate for corrosion control hangars based on a Department of the Navy Deputy for Environmental Affairs interpretation of paint spray booth definition. Contact NAVFACENGCOM Criteria Office prior to initiating final design.

Filters throughout should be made from noncombustible materials and should meet approval of the fire protection authorities. Filters upstream of the supply fan and filters in the door plenum should have an efficiency of 30 percent on the basis of ASHRAE 52.1, Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter. Filters in the exhaust wall should have an efficiency of 12 percent paint arresting pre-filter plus 60 percent. The type of exhaust filter system should be determined by an analysis of environmental control regulations at the site. The use of air-assisted, air less, or electrostatic paint spray methods versus conventional air atomization is recommended to reduce overspray and increase exhaust filter life. Visual gauges, audible alarms, or pressure activated devices should be installed on filters to ensure that the air velocity is maintained. Exhaust ventilation from the floor level should be provided for the paint mixing and storage rooms at the rate of 0.00047 cubic meter/s (1 cfm) per .093 square meter (1 sf) of floor area up to a maximum of 0.071 cubic meter/s (150 cfm). The ventilation systems for paint mixing and paint equipment cleaning rooms should be provided in accordance with NFPA 33 and the ACGIH Industrial Ventilation, a Manual of Recommended Practices. Consider heat recovery in the ventilation system for those spaces. Exhaust stacks should be the "no loss" type as shown in ACGIH Industrial Ventilation, a Manual of Recommended Practices.

3.4.3 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01 and as follows:

a) Provide toilet and shower facilities for both sexes.

b) Provide an emergency eyewash/safety shower conforming to ANSI Z358.1, and floor drains in hangar bays, paint mixing rooms, and paint equipment rooms. Refer to par. 3.8.a) for discharge requirements.

c) Provide an oil separator for drains from the hangar area and paint mixing rooms and paint equipment cleaning rooms.

d) Storm-water drains should be located a minimum of 305 mm (12 inch) from the hangar access door rails.

e) Provide AFFF/sprinkler discharge collection/ retention system when required by environmental regulations.

f) Provide a connection to the station Industrial Waste Treatment System or to a collection tank from all drains. The corrosion control process generates large amounts of water that could potentially hold solid or liquid paint residue or other solvents and wastes.

3.4.4 Compressed Air. Provide low pressure air for operation of tools and for breathing air in accordance with the following criteria:

a) Provide low pressure compressed air at 40 percent to 60 percent humidity and at 862 kPa (125 psig) for shop use. Air should be oil-free to prevent paint contamination. Air outlets supplying tools requiring lubrication should be equipped with an in-line lubricator. Rotary oil-free compressors are recommended since this compressed air may be used as a source for breathing air at lower life cycle costs.

b) Provide low pressure compressed air at 138 kPa (20 psig) or higher if required, at 40 percent to 60 percent humidity for breathing air in the hangar bays. Breathing air may be obtained from the oil-free shop air source through final purifiers in each bay or from a separate breathing air compressor and piping system. Breathing air from the oil-free shop air source is preferred because of lower cost.

c) The air outlets (quick connect fittings) for oil-free shop air, lubricated tool air, and breathing air should be

different for each service and should not be compatible with each other.

d) Typical outlet quantities for each bay are: four breathing and four oil-free shop air and two lubricated tool air. Typically, two oil-free shop air outlets are required per ancillary space. Verify actual requirements for each site.

e) Ensure the intake for breathing air is located in an uncontaminated area.

3.4.5 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with Army TM 5-805-4. Design hangar bay for maximum 75 dBA space average. Provide sound traps to attenuate fan noise down to this level. Noise levels of 55 dBA in the hangar bay area with the ventilation system operating at maximum airflow have been achieved with careful design attention to fan and duct noise characteristics. Outdoor noise levels should not exceed 75 dBA and should comply with local regulations.

3.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/4 and as defined in pars. 3.5.1 and 3.5.2.

Electrical equipment in the hangar bay should be waterproof when deluge sprinkler protection is provided to prevent equipment damage in the event of testing or accidental discharge of the deluge system.

3.5.1 Electrical Installations. Electrical installations in the following areas should meet the requirements in NFPA 70 for the specific hazardous (classified) location:

a) Hangar area,

b) Paint and chemical mixing rooms,

c) Paint equipment cleaning room,

d) Paint storage room.

3.5.2 Lighting. The electrical requirements for lighting should be as follows:

a) Interior lighting in the main hangar bays should provide 1076 lux (100 footcandles) measured 0.76 meters (30 inch) above the floor using metal halide fixtures. Future aircraft finishes may require other types of lights. Lighting intensities elsewhere are to be in accordance with MIL-HDBK-1190.

b) Exterior lighting should be high-pressure sodium vapor where practical and should be in accordance with MIL-HDBK-1004/4.

c) Provide power outlets in the hangar bays for task lights such as underwing task lighting.

d) Avoid the use of explosion-proof overhead fixtures by providing sealed, ventilated space above the finished ceiling.

3.5.3 Grounding. Two flush floor-ground receptacles, each with a 19 mm (3/4-in.) diameter ground rod, 3.05 meters (10 feet) minimum length, should be provided near the center of the aircraft position, with one on each side of the positioned aircraft. Resistance to ground should be 25 ohms maximum. Bond ground receptacles together with No. 4 AWG bare copper in or below the hangar floor. See Figure 1 in par. 2.5.4 for typical static grounding details.

3.6 Weight-Handling Equipment. The monorail hoist should be in accordance with criteria in NAVFAC DM 38.01 and should be of spark-proof construction with an explosion-proof motor. Controls should be operable from the floor level and, when electric, should meet the requirements indicated in par. 3.5.1.

3.7 Fire Protection. The fire protection design should be in accordance with MIL-HDBK-1008C. The following features should be provided:

a) In the hangar bays, requirements of par. 2.10.1 should be met.

b) In the ancillary spaces, automatic wet-pipe sprinkler system should be provided.

c) Provide manual and automatic fire alarm system reporting to the base-wide system.

3.8 Environmental. Design should be in accordance with environmental protection regulations and the requirements as follows:

3.8.1 Floor Drains and Waste Disposal System. Design for accidental spill of paint strippers and thinners, paint, cleaning solvents, pretreatment chemicals, fuel, oil, AFFF, etc. Provide for zero discharge from the facility unless the facility will discharge to an existing or new industrial waste treatment facility (IWTF) or to a municipal sewer system. In each case, the IWTF must be capable of handling both the type and volume of the chemicals that will be discharged. Consult the EFD or EFA Environmental Branch for appropriate discharge standards. Provide above-grade containment of accidental spills with appropriate sumps for pumping and cleanup of spilled wastes. Size the containment capacity for the largest possible discharge. Provide a method to ensure that the drains are prevented from clogging.

3.8.2 Volatile Organic Compounds (VOC). Every effort should be made to achieve compliance by use of compliant coatings vice use of VOC emission controls.

Section 4: AIRCRAFT WEAPONS ALIGNMENT FACILITY

4.1 Function. The aircraft weapons alignment facility should be designed to contain space and equipment for the alignment of on-aircraft weapons systems. In addition to weapons systems alignment, which is the process of mechanically and electrically aligning aircraft weapons electronic systems to a common aircraft axis, this facility provides space for on-aircraft electronic maintenance of the weapons system. Refer to NAVFAC P-80 to determine the size of this facility. See the facility plates for single-bay and multiple-bay configurations. For the mechanical alignment of guns attached to aircraft, refer to Section 10.

4.2 Location. The location selected for the aircraft weapons alignment facility must be free of vibration and electromagnetic interference that will adversely affect the weapons alignment. You must provide for the radar radiation clearance distances as shown on the facility plates. With these conditions met, the location that requires the minimum amount of new aircraft access pavement should be selected.

4.3 Architectural and Structural Requirements. In addition to the following special requirements, the aircraft weapons alignment facility should be designed using the general architectural criteria for maintenance hangars set forth in par. 2.3.

4.3.1 Structure. The facility should be a steel frame modular structure. Each equipment room should be provided to house the ground support equipment air conditioner and hydraulic test stand that are applicable to the aircraft being serviced. The mechanical room should provide for the utilities called for in pars. 4.4 and 4.5.

4.3.2 Walls. Except for the rear wall of the facility, the exterior walls should be preformed (corrugated), protected, insulated metal panels or insulated concrete masonry units. That portion of the rear wall within the radiation zone should be completely free of metallic or conductive materials to prevent reflection of the radar beam.

The enclosing walls for mechanical and toilet rooms should be solid masonry. The enclosing walls for equipment rooms should have a 1-hour fire rating.

Openings should be provided in walls of each equipment room for the passage of air conditioning ducts and hydraulic lines, if required by the aircraft slated to use the facility. Openings should be equipped with sleeves with smooth, rounded edges and top-hinged closure doors.

4.3.3 Roofs. Roofs should be designed as described in par. 2.3.2.

4.3.4 Floors. Floors should be designed to withstand the wheel loads of the heaviest fighter or attack aircraft, in accordance with criteria in MIL-HDBK-1021/2 and MIL-HDBK-1021/4.

The floor should slope to trench drains along the front sliding doors at 1/16 inch per ft (2.0 mm per 305 mm).

4.3.5 Doors. Doors should be provided that meet the following criteria:

a) Front workbay doors should be as described in par. 2.3.6.1.

b) The rear wall of the facility should contain an insulated door 10 ft (3.05 m) wide by 12 ft (3.66 m) high, without a curb or sill, to provide an exit for a tug. The door and door frame should be constructed of materials that are nonmetallic and nonconductive.

c) Personnel doors between the workbays, equipment, and toilet rooms should be as described in par. 2.3.6.2.

d) For other doors, provide stock industrial doors in accordance with the appropriate specifications as listed in MIL-HDBK-1000/1.

e) Provide personnel exit doors as described in par. 2.3.6.5.

f) A vehicle access door must be provided either within or adjacent to the hangar aircraft access doors.

4.3.6 Exterior Pavement. Exterior paved areas should be provided for aircraft access in accordance with MIL-HDBK-1021/2 and MIL-HDBK-1021/4; and vehicle access in accordance with facility plates in this handbook, and NAVFAC DM-5.04.

4.3.7 Harmonization Target. A remote-controlled, horizontally movable harmonization target should be provided to facilitate aircraft alignment.

4.4 Mechanical Requirements

4.4.1 Heating. Heating should be provided in accordance with MIL-HDBK-1003/3. The facility should be equipped with an automatic cutoff of the heating system when the doors are open. Provide a minimum temperature thermostat field set at 34 degrees F (1 degree C) to override the heating deactivation switch during door-open periods of subfreezing ambient temperatures. The recovery time for the heating system should be 15 minutes after the doors are closed. In a multiple-bay facility, each bay should be a separate heating zone. A snow-melting system at the sliding door tracks should be installed when the outside design temperature is plus 25 degrees F (-4 degrees C) or lower and when historical snow accumulation data supports the requirement.

4.4.2 Ventilation. Ventilation should be provided in accordance with MIL-HDBK-1003/3.

4.4.3 Air Conditioning. Air conditioning should be provided in accordance with MIL-HDBK-1003/3 and MIL-HDBK-1190. Automatic thermostatic control should be provided, and equipment should be shut down when not required for cooling.

4.4.4 Noise and Vibration Control. Hot and cold water should be provided for one toilet room at each facility, in accordance with NAVFAC DM-3.10, Noise and Vibration Control of Mechanical Equipment. Storm water drains should be located a minimum of 12 in. (305 mm) from the hangar access door rails.

4.5 Electrical Requirements. Electrical systems should meet the criteria of MIL-HDBK-1004/4 and pars. 4.5.1 through 4.5.3.

Electrical equipment in the hangar bay should be waterproof when deluge sprinkler protection is provided to prevent equipment damage in the event of testing or accidental discharge of the deluge system.

4.5.1 Power Outlets. Each bay should be provided with the following power outlets at the workbenches: single-phase, 120 V, 20 amperes, 60 Hz; threephase, 480 V, 60 Hz; three-phase, 115/200 V, 400 Hz; and 28 V direct current. The ampacity of three-phase and direct-current outlets should be as required by the using agency for the specific facility. Refer to NFGS-16268, 400Hertz (Hz) Solid State Frequency Converter for 400 Hz power requirements.

4.5.2 Lighting. The interior lighting in the workbays should be an energy-efficient type, such as high-pressure sodium vapor. Interior lighting in other spaces and task lighting above work benches should be fluorescent. Design for lighting intensities should be in accordance with MIL-HDBK-1190 and should take into consideration the reflectance of wall and floor surfaces. A system of flashing warning lights should be provided to identify workbays where aircraft radar is operating. Exterior lighting should be of the high-pressure sodium vapor type where practical and should be in accordance with MIL-HDBK-1004/4.

4.5.3 Grounding. Two flush floor-ground receptacles, each with a 3/4-in. (19 mm) diameter ground rod, 10 ft (3.05 m) minimum length, should be provided near the center of the aircraft position, with one on each side of the positioned aircraft. Resistance to ground should be 25 ohms maximum. Ground receptacles should be bonded together with No. 4 AWG bare copper in or below the workbay floor.

4.6 Fire Protection. The fire protection design should be in accordance with MIL-HDBK-1008C and par. 2.10.

Section 5: PAINT FINISHING HANGAR

5.1 Function. The paint finishing hangar should be designed for use only as a part of a NADEP or a selected intermediate maintenance activity as determined by the major claimant and approved by the Shore Development Board for cleaning, painting, and curing aircraft surfaces using production line methods. In addition to the workbays, storage, and administrative spaces should be provided.

5.2 Location. The paint finishing hangar should be located with due regard to the requirement for aircraft and vehicle access. In orienting the building, consider the prevailing wind in relation to the intake and exhaust of large volumes of air for the ventilation system.

5.3 Arrangement. The workbays should be arranged so that each has ready access to the outside and to equipment and storage spaces of the hangar. Workbays in which cleaning and stripping are done should be isolated from workbays in which painting and curing are done. Administrative spaces such as work control offices may be accommodated in mezzanines. Mechanical equipment rooms should be provided with outside access.

5.4 Architectural and Structural Requirements. Each hangar should be designed for the size and configuration of the specific aircraft to be handled. Workbay dimensions, ceiling heights, and door openings are determined by the aircraft dimensions. The number of workbays is determined by the workload. In addition to the following specific requirements, the paint finishing hangar should be designed using the general architectural criteria for maintenance hangars, as set forth in par. 2.3.

5.4.1 Structure. Noncombustible construction materials should be used in the hangar construction. Reinforced concrete slabs (with perimeter insulation) and columns with insulated masonry exterior walls are preferred. Refer to the criteria manual series on structural engineering. The requirements of NFPA 33 should be incorporated into the design of this facility.

5.4.2 Roofs. Roofs should be designed in accordance with par. 2.3.2.

5.4.3 Walls. Workbays and spaces used for paint and chemical mixing should be isolated with 2-hour fire-rated walls.

5.4.4 Floors. Workbay floors should be designed in accordance with the criteria in MIL-HDBK-1021/2 and MIL-HDBK-1021/4. Other floors should be designed in accordance with the criteria manual series on structural engineering and should be provided with floor coverings, as designated in MIL-HDBK-1001/2.

5.4.5 Ceilings. Administrative and personnel spaces should be provided with a noncombustible, suspended acoustical ceiling.

5.4.6 Doors and Door Controls. Doors should be designed in accordance with par. 3.3.6.

5.4.7 Building Insulation. Building walls, roof, and floor should be insulated in accordance with par. 1.9.

5.4.8 Surface Treatment. In addition to the requirements in par. 2.3.8, walls, inside surfaces of doors, and ceilings of workbays should be provided with a light-colored, smooth, hard surface.

5.4.9 Exterior Pavement. Exterior paved areas of the hangar include aircraft and vehicle access and nonorganizational parking. Aircraft pavement should be in accordance with MIL-HDBK-1021/2 and MIL-HDBK-1021/4, and vehicle access and parking should be in accordance with NAVFAC DM-5.04, and MIL-HDBK-1190.

5.5 Mechanical Requirements. The paint finishing hangar should be designed to meet the criteria set forth in pars. 5.5.1 through 5.5.6.

5.5.1 Heating. Heating should be provided as described in par. 3.4.1.

5.5.2 Ventilation. Provide ventilation in accordance with par. 3.4.2.

5.5.3 Air Conditioning. Provide air conditioning for administrative areas in accordance with MIL-HDBK-1003/3.

5.5.4 Plumbing. Plumbing should be provided in accordance with par.3.4.3. Industrial waste system, if required by facility pollution control procedures for control of paint stripping residue, should be provided. Storm water drains should be located a minimum of 12 in. (305 mm) from the hangar access door rails.

5.5.5 Compressed Air. Compressed air should be provided in accordance with par. 3.4.4.

5.5.6 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

5.6 Fire Protection. The fire protection design should be in accordance with MIL-HDBK-1008C and par. 2.10.

5.7 Environmental Controls. The type of environmental controls required will depend on the pollution abatement regulations at the site and the type and quantities of paints expected to be used. Environmental controls can be a major construction and operating cost item; therefore, an accurate determination of regulations and paints (existing and proposed) is required prior to design.

Section 6: AVIATION LIFE SUPPORT SYSTEMS SHOP

6.1 Function. The Aviation Life Support Systems Shop should be designed to contain space and equipment for the inspection, repair, and repacking of aviators' safety and survival equipment. Safety and survival equipment includes parachutes, life rafts, antiexposure wet suits, flotation vests, liquid oxygen systems, onboard oxygen generating systems, and ejection seats. Under current maintenance techniques, drying towers for parachutes are not normally needed and must be justified on an individual basis. The Aviation Life Support Systems Division is broken down into four separate work centers besides the division offices and Production Control Shop work centers and include:

a) The Parachute Shop,

b) The Aviation Safety Equipment Shop,

c) The Oxygen Regulator and Equipment Shop, and

d) The Ejection Seat Shop.

The space and facility requirements for the Ejection Seat Shop should be justified separately, as most seat work is now transitioning from organizational level maintenance to depot with no impact on I level facilities.

6.2 Location. The Aviation Life Support Systems Shop should be located in proximity to the hangars and within or near the intermediate maintenance shop complex. This shop should be oriented to minimize the possibility of dust, dirt, or moisture blowing into the building.

6.3 Architectural Requirements

6.3.1 General. The Aviation Life Support Systems Shop should meet the following architectural requirements:

a) It should be a single-story structure with an interior clearance to the finished ceiling to suit the equipment maintained. Where MK-20 life rafts are supported, an interior clearance to the finished ceiling or suspended lighting of 18 ft (5.49 m) is required in the Aviation Safety Equipment Shop to turn the raft over during inflation checks. The building is to

be of modular steel girder construction with insulated concrete masonry unit (CMU) walls, insulated preformed (corrugated) metal walls, or a combination of the two.

b) The roof should be of insulated metal roof panels or insulated built-up roofing assemblies, which meet the requirements of Underwriters Laboratories, Inc. (UL), Building Materials Directory, for fire-acceptable roof deck construction or Factory Mutual Engineering Corporation (FM), Approval Guide for noncombustible deck construction.

c) Access to the shops should be through two pairs of double doors forming a foyer. Double doors should also be required for material and equipment passage into the workrooms. Exterior doors to work rooms should be equipped with full contact dustproof gaskets and automatic door bottoms.

d) Windows should not be permitted in areas where direct sunlight can reach parachute fabric. If used, windows should be double glazed or shaded, depending upon local climatic conditions.

e) Refer to the facility plates and NAVAIR 13-1-6.2, Manual Aviation Crew Systems Parachutes, for various layouts and other criteria for this shop.

6.3.2 Packing Room. The shop should contain a packing room with space for 45 ft (14.6 m) parachute packing tables. Tables should be located so that there exists a minimum of 6 ft (1.83 m) from the walls at the sides and ends and 4 ft (1.22 m) between tables. The tables should be 36 in. (914 mm) wide by 36 in. (914 mm) high and have smooth hard tops of a color to reduce reflection and eyestrain. Where tables are sectional to permit their deployment, edge treatment should be such that parachute fabric cannot be snagged. A suspended acoustical tile ceiling system should be provided in the packing room for the purpose of eliminating dust and dirt accumulation in the overhead area. The floor in this area should be steel-trowel-finished concrete or resilient tile.

6.3.3 Sewing and Fabrication Room. The shop should contain a sewing and fabrication room with space for cutting tables and sewing machines for repair and fabrication of parachutes and

other survival equipment. Space should also be provided for storage of fabric and materials.

6.3.4 Parachute Storage. The shop should contain facilities for repacked parachutes to be stored in smooth surfaced individual bins 20 in. (508 mm) wide, 26 in. (660 mm) high, and 25 in. (635 mm) deep. To provide for air circulation, bins should be open both front and back. The height should not exceed 70 in. (1778 mm) from floor to top of bin, and the bottom shelf should be 18 in. (457 mm) from the floor.

6.3.5 Flotation Room. Doors between the flotation room and other parts of the shop should be fully weatherstripped and equipped with automatic door bottoms to eliminate transfer of talcum powder to other parts of the building.

6.3.6 Oxygen and Carbon Dioxide Room. The shop should contain a separate enclosed room for servicing and testing oxygen and carbon dioxide equipment and components. Double doors should be provided to permit moving large test equipment into the area. A covered and protected area should be provided outside of the building and adjacent to the oxygen room for storage of oxygen and nitrogen bottles. The area should be arranged to permit storage of bottles on skids and handling of skids by forklifts. Openings should be provided in the exterior wall for an exhaust line from test equipment and for piping from the oxygen and nitrogen storage area.

6.3.7 Exterior Pavement. The exterior paved areas should include vehicle access and nonorganization vehicle parking. Refer to facility plates in this handbook and MIL-HDBK-1190 for parking criteria.

6.4 Mechanical Requirements. The Aviation Life Support Systems Shop should meet the mechanical requirements defined in pars. 6.4.1 through 6.4.4.

6.4.1 Heating, Ventilating, and Air Conditioning. Heating, ventilating, and air conditioning (HVAC) should be provided in accordance with MIL-HDBK1003/3 and as follows:

a) Ductwork delivering supply air to the packing room should be run above suspended acoustical ceiling or be located

to prevent dirt accumulation on top of the duct over packing tables.

b) Air conditioning should be provided to limit the relative humidity to 50 percent, plus or minus 10 percent.

c) Humidification should be provided in parachute packing and storage areas, as required by the locality of the facility, to maintain the relative humidity within the acceptable zone shown in Figure 4.

d) The raft room should be kept at a negative pressure relative to adjacent spaces to prevent spread of talcum. A makeup air and local exhaust system with dust collector is required to control talcum dust. The design should be in accordance with the ACGIH Industrial Ventilation, A Manual of Recommended Practice.

6.4.2 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01 and as follows:

a) Hot and cold water and floor drains should be provided in toilets, cleaning gear room, raftshop, and the parachute washing machine.

b) A leak test tank should be provided in the Personal Flotation Equipment Shop.

6.4.3 Compressed Air and Vacuum. Compressed air and vacuum systems should be provided in accordance with NAVFAC DM-3.05 and as follows:

a) Low pressure, oil-free compressed air at 30-60 psi (207-414 kPa) is required in the survival equipment room and the flotation room. The air supply should have a minimum capacity of 50 cfm (0.024 cubic meters/s) and should be adequate to inflate large life rafts in the flotation room.

b) A vacuum source should be provided in the personal flotation room and raft shop for deflation of rafts and vests. The preferred method is portable, industrial-grade shop vacuum cleaners.

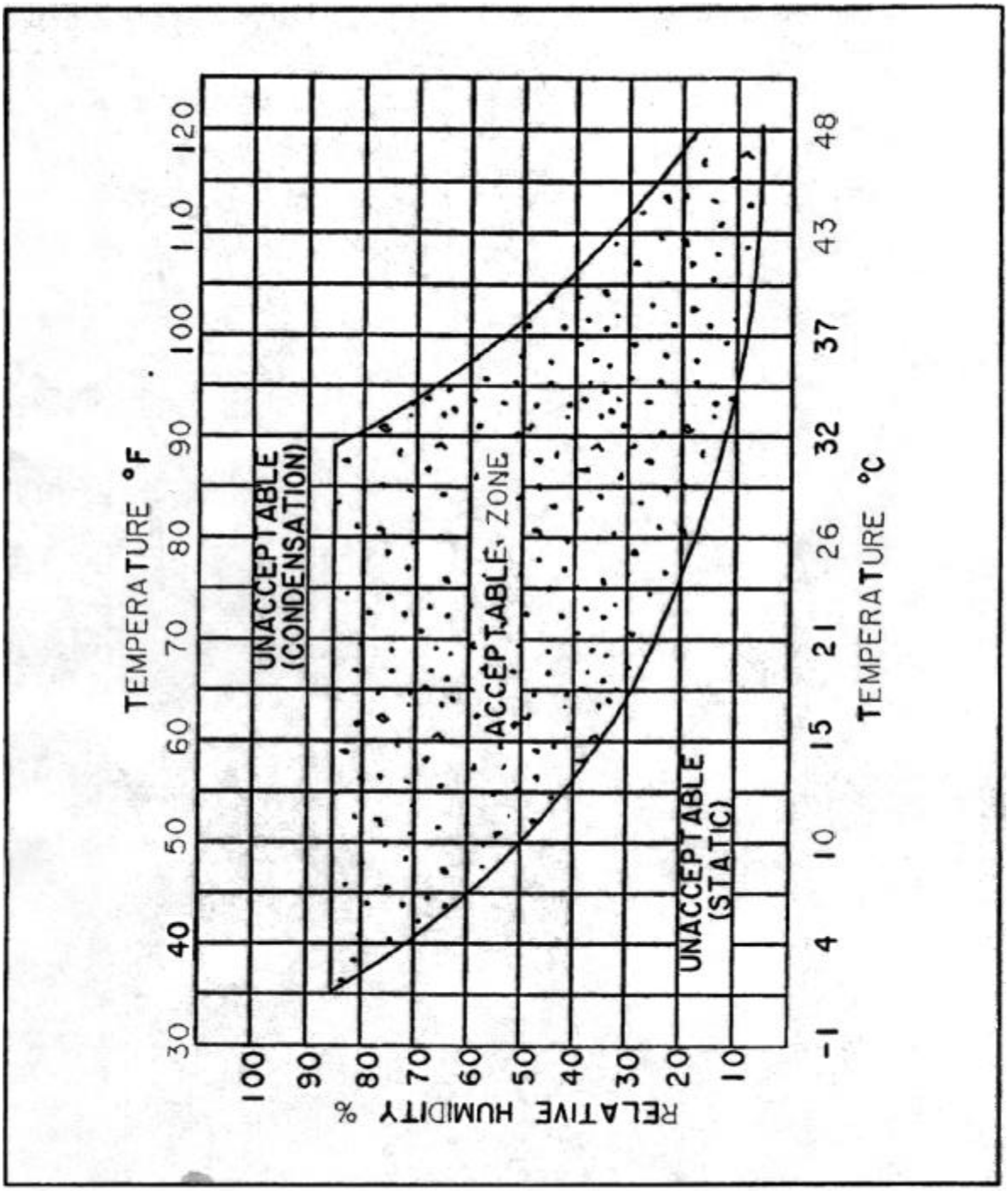


Figure 4
Parachute Packing and Storage Relative Humidity Limits

6.4.4 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

6.5 Electrical Requirements. The Aviation Life Support Systems Shop should meet the electrical requirements of MIL-HDBK-1004/4 and pars. 6.5.1 through 6.5.2.

6.5.1 Power Outlets. All areas should be provided with single-phase, 120 V, 20 ampere, 60 Hz outlets spaced as required by NFPA 70. The sewing and fabrication room should be provided with three-phase, 120/208V, 20 ampere, 60 Hz outlets located as required by the using agency for the specific facility. Three-phase, 120/208 V, 20 ampere, 60 Hz power should be provided for test equipment in the oxygen room and for pressurizing equipment in the carbon dioxide transfer room.

6.5.2 Lighting. Lighting throughout the facility should be fluorescent. Fixtures in the packing room should be recessed when suspended ceilings are provided, run parallel to the packing tables, and located so that shadows are not cast across work surfaces. Exterior lights should be the high-pressure, sodium vapor type where practical. Lighting intensities should be designed in accordance with MIL-HDBK-1004/4 and the Illuminating Engineering Society of North America (IES), Lighting Handbook.

Section 7: ENGINE MAINTENANCE SHOP

7.1 Function. The Engine Maintenance Shop (Power Plant Division) should be designed to contain space and equipment for maintaining aircraft engines, propellers, helicopter rotors (rotor dynamics), and auxiliary fuel tanks and air-to-air refueling stores. Individual justification based on assigned aircraft or maintenance capability must be provided to authorize space for propeller, rotor dynamics, and auxiliary fuel stores maintenance (refer to NAVFAC P-80).

7.2 Location. The Engine Maintenance Shop should be in close proximity to the engine test cells and the maintenance hangars. Direct access to aprons is not required.

7.3 Architectural and Structural Requirements. For architectural and structural requirements, refer to MIL-HDBK-1001/1, Basic Architectural Requirements and Design Considerations, MIL-HDBK-1002/2, Loads and pars. 7.3.1 through 7.3.4.

7.3.1 High Bay. The main work area should be designed for engine teardown and reassembly and equipped with an overhead bridge crane of 6-ton capacity. A second overhead crane of 6-ton (5 443 kg) capacity should be installed if justified according to NAVFAC P-80. A clear height of 24 feet (7.3 m) should be maintained between the floor and the hook of the bridge crane. Access from outside should be provided through four 20-foot (6.1 m) wide, 10-foot (3.05 m) high rollup doors.

7.3.2 Shop Areas. The shop areas should be designed to house the rotor dynamics, propeller, and auxiliary fuel store work centers, as well as engine AWP, AWM, and ready for issue (RFI) storage, expendable supplies, and cleaning (steam and solvent) areas with the number and size of cleaning tanks determined by the type and number of aircraft being supported. Mechanical equipment and transformer rooms, as well as welding and accessory shops, should also be located in the shop areas. Sizing of the Rotor Dynamics Shop is dominated by the length of the main rotor blades. The Propeller Shop requires an 18-foot (5.5 m) ceiling to accommodate propellers on stands and should have a 2-ton (1 814 kg) crane. Both the Rotor Dynamics Shop and Propeller Shop should be designed to eliminate drafts during

blade balancing operations. The Auxiliary Fuel Stores Shop should be designed to accommodate extending and retracting the 45-ft (13.7 m) fuel hose. A waste oil/solvent containment and storage facility should be provided.

7.3.3 Other Spaces. Toilet facilities should be provided with lockers and showers for men and women. The coffee mess should be provided and equipped with a sink and utilities for dispensing machines. A cleaning gear room should be provided. Office spaces should contain areas for a division officer, division personnel, training, and naval engineering technical specialist/ naval aviation engineering service unit personnel. Resilient floor covering and washable wall finish should be provided in the administrative spaces.

7.3.4 Exterior Pavements. Exterior paved areas include vehicle access, outside storage for sealed engine containers, and nonorganizational vehicle parking.

7.4 Mechanical Requirements. The mechanical requirements for the Engine Maintenance Shop are defined in pars. 7.4.1 through 7.4.6.

7.4.1 Heating. Heating should be provided in accordance with MIL-HDBK-1003/3.

7.4.2 Ventilation. Ventilation and exhaust systems should be designed in accordance with MIL-HDBK-1003/3 and provide:

a) Mechanical ventilation for spaces that are not air conditioned,

b) Heated outside air to the cleaning and welding areas, and

c) Exhaust systems in accordance with the ACGIH, Industrial Ventilation, A Manual of Recommended Practice, for the cleaning and welding areas to remove solvent and welding fumes from the building to provide a safe work environment.

7.4.3 Air Conditioning. Air conditioning should be provided for personnel/administrative spaces in accordance with MIL-HDBK-1003/3.

7.4.4 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01 and as follows:

a) Steam should be provided at 30 psi (207 kPa) with a capacity of 200 pounds per hour (0.025kg/s) to the steam cleaning room. Electricity and water supplies should be provided if portable steam generators are used in lieu of building steam system.

b) Hot and cold water should be provided to the cleaning area, inspection area, coffee mess, cleaning gear room, and toilets.

c) An oil/water separator should be provided for drainage systems from solvent and spray cleaning and steam cleaning areas as required for compliance with environmental regulations.

d) A waste recovery system should be provided for film developing operations to segregate and collect silver bearing waste in accordance with NAVSUPINST 4570.23, Navy Precious Metals Program (PMP).

7.4.5 Compressed Air. Low pressure compressed air at 125 psi(862 kPa) should be provided in accordance with NAVFAC DM-3.05, Compressed Air and Vacuum Systems to the main work area and shop areas. Air outlets should be provided, at a spacing of 24 feet (7.3 m) in the main work area.

7.4.6 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

7.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/4, and as defined in pars. 7.5.1 through 7.5.3.

7.5.1 Power Outlets. Power outlets should meet the following criteria:

a) Single-phase, 120 V, 20 ampere, 60 Hz outlets should be provided in all areas.

b) Three-phase, 480 V, 60 Hz outlets should be provided in the Welding Shop and Inspection Shops and at a spacing of 24 ft (7.3 m) in the main work area and in the propeller, rotor dynamics, and auxiliary fuel store work centers.

c) Three-phase, 115/200 V, 400 Hz outlets should be provided in the accessory shop.

d) The ampacity of three-phase outlets should be as required by the using agency for the specific facility.

7.5.2 Lighting. Interior lighting should meet the following criteria:

a) Interior lighting should be an energy-efficient type such as high-pressure sodium vapor in the high bay area. Other interior lighting will be fluorescent.

b) Exterior lighting should be high-pressure sodium vapor where practical.

c) Design for lighting intensities should be in accordance with MIL-HDBK-1190.

d) Photo laboratory lighting.

7.5.3 Communications. An intercommunications system to allow two-way voice communications should be provided between the production control office and the major shop areas. A 3M communications system outlet should be provided in the production control office for connection to the AIMD office located in another building (refer to par. 1.8).

7.6 Weight-Handling Equipment. The overhead bridge crane and monorail hoist should be in accordance with criteria in NAVFAC DM-38.01 and the following requirements:

7.6.1 Bridge Crane. Each overhead bridge crane should have an electric, motorized bridge, trolley, and hoist and should be 6-ton (5 443 kg) capacity. The trolley and bridge should be capable of operating at a slow speed of 15 to 20 feet/minute (0.076 to 0.10 m/s) for positioning loads and at a high speed for moving loads of 60 feet/minute (0.305 m/s). The hoist should be capable of operating at a slow speed of 3 to 4

feet/minute (0.015 to 0.02 m/s) and at a high speed of 12 feet/minute (0.061 m/s), also refer to NFGS-14637.

7.6.2 Motor and Controls. The bridge, trolley, and hoist controls should provide for two-speed reversing of a two-speed squirrel-cage motor. The controls should be equipped with reduced voltage starting for the motors. Controls should be operable from the floor.

Section 8: AIRFRAMES SHOP

8.1 Function. The Airframes Shop should be designed to contain space and equipment for maintaining aircraft at the intermediate maintenance level. The Airframes Division, in addition to the division offices, has 11 separate work centers organized in four branches as follows:

a) The Structures Branch consists of a Structures Shop, Paint Shop, Welding Shop, Machine Shop, Wheel and Tire Shop, and Composites Shop.

b) The Hydraulics/Pneumatics Branch consists of a Hydraulics Shop, Brake Shop, and Strut Shop.

c) The NDI (Nondestructive Inspection) Branch consists of a Radiography Shop, Electrical/Chemical Shop, and an Electroplating/Anodizing Branch. This branch is not normally required and is authorized on an individual AIMD basis. Refer to NAVFAC P-80 to determine allowance, size, and space requirements and additional special requirements for this facility.

8.2 Location. The Airframes Shop should be located in proximity to the maintenance hangars within the intermediate maintenance shop complex. Direct unobstructed vehicle access is required.

8.3 Architectural Requirements. The Airframes Shop should be designed to meet the requirements of pars. 8.3.1 through 8.3.8.

8.3.1 Walls. Walls should be insulated CMUs, insulated preformed (corrugated) metal panels, or a combination of both.

8.3.2 Roof. The roof should be constructed of insulated metal panels or insulated built-up roofing in accordance with par. 2.3.2.

8.3.3 Floors. Floors in the shop area should be designed for loads as specified in MIL-HDBK-1002/2,and should have nonslip, easily cleaned finishes.

8.3.4 Doors. Double doors into shop areas should be as large as practical to permit the installation of large equipment.

8.3.5 Finishes. Architectural finishes of the personnel spaces should be in accordance with MIL-HDBK-1001/1.

8.3.6 Clean Room. A horizontal laminar flow clean room, designed in accordance with MIL-HDBK-1028/5, Environmental Control - Design of Clean Rooms, should be provided as a part of the hydraulics and pneumatic shop area.

8.3.7 Paint Shop. The paint shop should meet the requirements of NFPA 33.

8.3.8 Exterior Pavement. For parking and access criteria, refer to MIL-HDBK-1190 and facility plates in this handbook.

8.4 Mechanical Requirements. The Airframes Shop should be designed to meet the requirements of pars. 8.4.1 through 8.4.8.

8.4.1 Clean Room. Mechanical requirements for the prefabricated clean room should be in accordance with criteria in MIL-HDBK-1028/5.

8.4.2 Heating. Heating should be provided in accordance with MIL-HDBK-1003/3. Design for an infiltration rate of two air changes per hour in the OH space.

8.4.3 Ventilation. Ventilation should be provided in accordance with MIL-HDBK-1003/3 for spaces that are not air conditioned as follows:

a) Exhaust systems with filtered and heated makeup air should be provided for the painting, welding, sandblasting, cleaning and plating, and fiberglass/plastics shops.

b) Ventilation for the paint shop should meet the requirements of NFPA 33.

8.4.4 Air Conditioning. Air conditioning should be provided in accordance with MIL-HDBK-1003/3 for administrative areas, the training room, library, first aid room, production control office, X-ray exposure room, X-ray film process room, and file room.

8.4.5 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01 and as follows:

a) Hot and cold water and floor drains should be provided in all shop areas except those for tire and wheel, machine shop, and structures shop areas.

b) Steam should be provided in the cleaning and plating, painting, and nondestructive testing work areas. The steam supply should normally be 30 psi (207 kPa), with a capacity of 200 pounds per hour (0.025 kg/s) per cleaning station.

c) A waste recovery system should be provided for film developing operations to segregate and collect silver bearing waste in accordance with NAVSUPINST 4570.23.

d) A safety shower/eyewash should be provided with fixtures as shown on facility plates in this handbook.

8.4.6 Compressed Air. Low-pressure compressed air at 125 psi (862 kPa) should be provided in shop areas in accordance with NAVFAC DM-3.05.

8.4.7 Nitrogen. Gaseous nitrogen, supplied by the using agency in portable cylinders at pressures to 4000 psi (27 579 kPa), is required in the tire and wheel work area. A nitrogen bottle rack and manifold assembly, complete with pressure regulator, pressure gages, and flexible hose, should be provided to connect to the nitrogen cylinders.

8.4.8 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

8.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/1, Preliminary Design Considerations and as defined in pars. 8.5.1 through 8.5.3.

8.5.1 Power Outlets. Power outlets should be provided in accordance with the following criteria:

a) Single-phase, 120 V, 20 ampere, 60 Hz convenience outlets should be provided in all spaces with spacing as required by NFPA 70.

b) Three-phase, 480 V, 60 Hz outlets should be provided in the hydraulic/pneumatic shop, structures shop, and welding shop areas.

c) Three-phase, 120/208 V, 60 Hz outlets should be provided in the cleaning and plating shop, paint shop, and nondestructive testing area.

d) 28 V direct current outlets should be provided in the hydraulic/pneumatic shop area.

e) The ampacity of three-phase outlets should be as required by the using agency for the specific facility.

8.5.2 Lighting. Lighting should be provided in accordance with the following criteria:

a) Interior lighting should normally be fluorescent.

b) Exterior lighting should be of the high-pressure sodium vapor where practical.

c) The lighting intensities should be designed in accordance with MIL-HDBK-1190.

8.5.3 Communications. A 3M communications system outlet should be provided in the production control office for connection to the AIMD offices located in another building (refer to par. 1.8). An intercommunications system to allow two-way voice communication should be provided between the production control office and the major shop areas.

8.6 Weight-Handling Equipment. The monorail hoist should have an electrically operated trolley and hoist with pushbutton, independent controls and should be in accordance with criteria in NAVFAC DM-38.01.

Section 9: AVIONICS SHOP

9.1 Function. The Navy and Marine Corps Avionics Shop should be designed to contain space and equipment for intermediate maintenance and repair of electronic and electrical airborne equipment and systems. In addition to the avionics division offices, the division has 10 branches that are broken down into a variety of shops, as follows:

Branch Code	Shop Code	Function	Definition
600		Avionics Division	Division Supervisory
60A		Avionics Corrosion Control	Cleaning, prevention, and control of corrosion in avionics components
610		Comm/Nav Branch	Comm/Nav branch supervisory
	61A	Communication Shop	Repair of communication radios
	61B	Navigation Shop	Repair of navigation radios
	61C	Computer Shop	Repair of aircraft computer systems
	61D	COMSEC/Crypto Shop	Repair of communication security equipment
620		Electrical/Instrument Branch	Electrical/Instrument branch supervisory
	62A	Electrical Shop	Repair of electrical components/lighting systems
	62B	Instrument Shop	Repair of aircraft instruments
	62C	Lead Acid Battery Shop	Charging and recharging and maintenance of lead acid batteries
	62D	Nickel Cadmium Battery Shop	Charging and recharging and maintenance of nickel cadmium batteries
	62E	Constant Speed Drive/Generator Shop	Repair of generators, generator controls, and generator drives
	62F	Inertial Nav Shop	Testing and repair of Inertial Navigation components
	62M	MIARS Repair	Repair of Maintenance Information Automated Retrieval System (MIARS) equipment
630		Fire Control Branch	Fire Control branch supervisory
	63A	AWG-9 Shop	Repair of components of the AWG-9 Weapons System
	63B	AWG-10 Shop	Repair of components of the AWG-10 Weapons System

Branch Code	Shop Code	Function	Definition
630 - continued	63D	APG-65 Shop	Repair of components of the APG-65 Weapons System
640		Radar/ECM Branch	Radar/ECM Branch supervisory
	64A	Radar Shop	Repair of Radar components
	64B	ECM Shop	Repair of Electronic Counter Measures components
	64C	DECM Shop	Repair of Defensive Electronic Countermeasures components
	64D	FLIR Shop	Repair of Forward Looking Infrared and Laser components
	64E	Pod Shop	Repair of underwing pods for containment of ECM, DECM, FLIR and associated components
650		SACE/ATE Branch	Semi-Automated Checkout/Automated Test Equipment branch supervisory
	65A	RADCOM Shop	Test of selected components using RADCOM computer based automated test equipment
	65B	CASS Shop	Test of selected components using CASS computer based automated test equipment
	65D	SACE Radar Shop	Test of selected components using computer based automated test equipment
	65E	Weapons Systems Missile Component Shop	Test of selected components using computer based automated test equipment
	65F	FTE/DTS Shop	Test of selected components using computer based automated test equipment
	65G	Avionics Test Set (ATS) Shop	Test of selected components using computer based automated test equipment
	65H	ATS Station Maintenance	Repair and maintenance of automated test equipment
	65P	VAST Shop	Test of selected components using computer based automated test equipment
	65Q	VAST Station Maintenance Shop	Repair and maintenance of automated test equipment
	65R	VAST TPS/MAMS Maintenance Shop	Repair and maintenance of ATE test program sets and maintenance assist modules

Branch Code	Shop Code	Function	Definition
650 - continued	65S	VAST Calibration Shop	Calibration of ATE
660		ASW Branch	ASW Branch supervisory
	66A	Acoustic Equipment shop	Repair of selected anti-submarine warfare components
	66B	Non-acoustic equipment shop	Repair of selected anti-submarine warfare components
670		PME Branch/Field Calibration Activity	Calibration Lab Supervisory
	67A	PME Receipt and Issue	Receipt and Issue of Precision Measuring Equipment requiring calibration
	67B	PME Electrical/ Electronic Calibration Shop	Repair and calibration of PME calibrated against electronic standards
	67C	PME Physical/ Mechanical Calibration Shop	Repair and calibration of PME calibrated against physical or mechanical standards
	67D	PME TAMS Repair shop	Repair of Test and Monitoring Systems
	67E	Computer Repair Shop	Repair of Desktop Personal Computers
680		Reconnaissance/Photo Branch	Repair of aircraft mounted photographic equipment
690		Module/Micro-miniature Repair Branch	Module/Micro-miniature Repair branch supervisory
	69A	Module Test/ Troubleshooting shop	Test and troubleshooting of modules
	69B	Micro/Miniature Repair shop	Repair of circuit cards and modules
	69C	Cable/Connector shop	Repair of aircraft wiring harnesses and connectors

Notes: Not all shops may be in use at a given IMA. Each IMA is set up based on the aircraft base load and to best serve its customers.

9.1.1 Battery Shops. Battery shops are included in the sizing of the Avionics Shops. If Battery Shops are to be constructed separately, or in conjunction with the Category Code

218 60 Aircraft Ground Support Equipment Shop, they may be assigned Category Code 218 50 Aircraft Battery Shop.

9.1.2 Mobile Facilities (MFs). Due to expanded use of mobile facilities (MFs) by both Navy and Marine Corps Intermediate Maintenance Activities (IMAs), the Avionics Shop size may need to be adjusted. MFs may be used to replace some or all Avionics Shops. Refer to NAVFAC P-80 for Category Code 211 45 for information on sizing avionics facilities when MFs are used and Category Code 116 65 mobile facility support pad for further information on the requirements for MF support.

9.2 Location. The Avionics Shop should be located in proximity to the Category Code 211 05 aircraft maintenance hangars, within the IMA complex, and near to the supply warehouses and screening points. Direct, unobstructed vehicle access to the loading area is required. The Avionics Shop may be part of a larger IMA building. In that circumstance, these design guides apply to the Avionics Shop portion of that structure.

9.3 Architectural Requirements. The Avionics Shop should be single story with an expandable floor plan. Use of interior partitions should be minimized to permit flexibility in space allocation and equipment modification and rearrangement.

9.3.1 Interior Partitions. Interior partitions, where possible, should be movable.

9.3.2 Floors. Floors in the general shop area should be designed for a live load of 1,465 kg/m^2 (300 psf). The Generation Test shop will be designed for 2442 kg/m^2 (500 psf) and the Cass High Power Device test set will be designed for 3120 kg/m^2 (639 psf) respectfully. They should have an epoxy hardened, dust proof, slip resistant finish. In all work shops where avionics and electronic equipment are repaired the floors should be covered with a non-conductive and static resistant flooring material. Flooring material should comply with ASTM D178.

9.3.3 Doors. Doors should be a regular industrial type except as required for security spaces. The door on the electronic countermeasures (ECM)/cryptographic (Crypto)

equipment vault should comply with DOD 5200.1R, including the X0-7 Electronic Door Lock and Access Control System. All exterior doors should be self closing fire doors. Hold-open devices should not be permitted. Doors on the CSD/Generator Test Room should be sound attenuated.

9.3.4 Finishes. Interior finishes should be in accordance with MIL-HDBK-1001/2, Materials and Building Components. To preclude damage from toolboxes or other equipment, a high impact acrylic/PVC sheet wall covering with a minimum thickness of 2.4 mm (.093 in.) should be applied to all wall surfaces in the shop area to a minimum height of 1.2 meters (4 feet). Corners will be protected with a similar material, also to a minimum height of 1.2 meters (4 feet).

9.3.5 Exterior Pavement. Exterior pavement should be provided for vehicle access and non-organizational parking. Refer to MIL-HDBK-1190 for parking criteria.

9.3.6 Roof Systems. The roof system, due to large surface area and proximity to operating aircraft, should be carefully selected. Expansion joints, insulation vents, and traffic pads or walkways should be provided where applicable. Insulation should be provided as required in par. 1.9. On built-up roofs, the design should preclude carrying gravel or slag aggregate from the roof surface by high winds or drainage to any area where aircraft operate. If mineral surfacing materials are used, they should be held in place by a coating of elastomeric asphalt. There will be no loose materials on roofs. The color of roof surfaces should be as described in par. 2.3.8. Provide gutter and outrigger downspouts. Provide access to the roof through a secured access panel or hatch, to prohibit unauthorized passage. Built-up roofing, insulation, and moisture protection should conform to the applicable guide specifications listed in MIL-HDBK-1000/1. Use one of the following systems:

a) Metal roof decking with insulated, built-up roof.

b) Poured-in-place gypsum slab on formboard with insulated built-up roof.

c) Other types of roofs based on cost and energy savings can be considered.

9.3.7 Clean Room. The clean room should be designed in accordance with MIL-HDBK-1028/5.

9.3.8 Gyroscope Testing Area. The Electrical Shop (Shop 62A) requires a freestanding concrete platform, approximately 1.83 meters (6 feet) square, on a special isolated foundation for maintenance of gyroscope systems. Refer to the latest equipment contractor's specifications at the time of the design.

9.3.9 Constant Speed Drive/Generator Test Room. The Constant Speed Drive (CSD)/Generator Test Room should be separated from the remainder of the shops. The walls should be constructed of at least .3 meters (12 inches) concrete to contain any pieces of a CSD or generator in the event of catastrophic failure. The walls should have sound attenuation. The control room should be separate with a view window of sound attenuated, shatter resistant materials.

9.3.10 Battery Rooms and Uninterruptible Power Supplies. Battery rooms should be designed in accordance with NAVFAC DM-28.4, General Maintenance Facilities. Nickel cadmium and lead acid battery rooms must be separate, and isolated from the remainder of the Avionics Building. There can be no common air path between the two battery types. The rooms should be exhausted directly to the outside with fresh makeup air provided. If an uninterruptible power supply (UPS) is required for the automated test equipment, it may be accommodated for by increasing the area in the lead acid battery room. Drains in the battery rooms should be connected to either the station industrial waste removal system or to a hazardous waste holding tank to allow capture and proper handling of any hazardous waste products.

9.3.11 Corrosion Control Shop. A Corrosion Control Shop consisting of a small cleaning area that may have a chemical or high pressure cleaning bath, desktop bead blast cabinet, paint booth, paint mixing area, and storage for hazardous materials and hazardous wastes is required. This area will require special air handling requirements to exhaust the paint booth and

mixing area. The requirements of NFPA 33 will be incorporated in to the design of the Corrosion Control Shop.

9.3.12 Avionics Building. The Avionics Building should be a secured area. Outside access should be only through the production control area, the precision measuring equipment/field calibration activity (PME/FCA) receipt and issue area, or the division administrative offices. Security doors with cipher locks are required at all entry points to the shop area. The ECM room should meet the requirements for a classification of Secret, while the Crypto repair room should meet the demands for a Top Secret classification. Security regulations for these rooms should be in accordance with the latest revisions of OPNAV 5510.1, Department of the Navy Information and Personnel Security Program Regulation and OPNAV 5530.14 Department of the Navy Physical Security and Loss Prevention.

9.3.13 Outside Access. The PME/FCA receipt and issue area, the Production Control Office, and the Division Administrative Offices should have outside access.

9.3.14 Production Control. In facilities, where the Avionics Shop is part of a larger building, the Avionics Production Control Office may be combined with the IMA Production Control office. Production control should be located adjacent to the supply support area (Category Code 441 10). The supply support area may include a loading dock, if needed.

9.4 Mechanical Requirements. The mechanical requirements of the Avionics Shop should conform to the criteria defined in pars. 9.4.1 through 9.4.6.

9.4.1 Heating, Ventilating, and Air Conditioning. Heating, ventilating, and air conditioning, including humidity and dust control, should be provided throughout shop spaces in accordance with MIL-HDBK-1003/3. Inside design temperature for shop spaces should be 24 degrees C (75 degrees F), with a relative humidity of 50 percent for cooling and 18 degrees C (65 degrees F) for heating. Other spaces should be heated, ventilated, and air conditioned in accordance with MIL-HDBK-1003/3. Special HVAC requirements must be provided to Automated Test Equipment shops to provide adequate cooling and dehumidified air for the various computer-based test equipment. See the manufacturers'

documentation, or contact the NAVAIR Program Office for the equipment to determine the exact requirements.

9.4.2 Special Exhaust Systems. The CSD/Generator Test Room requires a separate exhaust system utilizing 100 percent outside makeup air. The battery rooms and uninterruptible power supply room should be provided with an exhaust system in accordance with NAVFAC DM-28.4. The ultrasonic cleaning tank in the module test and repair room, the paint booth, paint mixing area, and cleaning equipment in the Corrosion Control Shop, the Instrument Shop, whether built as a clean room or with laminar flow benches, and each solder station should be provided with an exhaust system with makeup air to remove toxic fumes in accordance with MIL-HDBK-1003/3.

9.4.3 Clean Room. Mechanical requirements for the clean room should be in accordance with MIL-HDBK-1028/5.

9.4.4 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01. Toilet and shower facilities should be provided for both sexes. All work centers should be provided with eyewash stations in accordance with ANSI Z358.1. The battery rooms, Corrosion Control Shop, and ultrasonic cleaner require drainage to the station industrial sewer or to a hazardous waste holding tank to allow capture and proper handling of any hazardous wastes generated. Each battery room should be provided with an eyewash and deluge shower with floor drain and other plumbing requirements in accordance with ANSI Z358.1 and NAVFAC DM-28.4.

9.4.5 Compressed Air and Nitrogen. Low pressure compressed air at 862 kpa (125 psi) should be provided in all shop areas. Nitrogen requirements must be determined for each area. Normal supply should be provided from regulated bottles.

9.4.6 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with Army TM 5-805-4. Special attention should be placed on the CSD/generator test room due to the high noise levels generated.

9.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/4; NAVAIR 01-1A-512

Design Guide for Avionics Shop Power Distribution, and pars. 9.5.1 through 9.5.5 of this handbook.

9.5.1 Electromagnetic Interference Shielding. Electromagnetic shielding should conform to the following criteria:

a) Utility services for the ECM/Crypto repair room may be required to be brought into the room by way of filters with attenuation characteristics, to prevent the radiation of intelligence data into the utility system. Requirements for electromagnetic interference shielding should be obtained from NAVAIR or the project sponsor. The shield room internal to the ECM/Crypto repair room should meet these same requirements for shielding. The shield room, including filters and compensators is normally purchased as a prefabricated item. No fluorescent lighting is permitted and incandescent lighting fixtures must be provided.

b) Alternating current and direct current power distribution should be run separately to preclude interference. Electromagnetic interference shielded fixtures are required in all spaces except the ECM/Crypto repair room.

c) Shielded enclosures should be in accordance with NFGS 13093, Radio Frequency Shielded Enclosures, Demountable Type, or NFGS 13094, Radio Frequency Shielded Enclosures, Welded Type. Power line filters should be provided in accordance with NFGS 16280, Radio Frequency Interference Power Line Filters.

9.5.2 Power Outlets. Power distribution should conform to the following criteria:

a) Provide single phase, 120 V, 60 Hz, 20 ampere convenience outlets in all areas, and adjacent to automatic test equipment/stations to facilitate calibration equipment during station maintenance and verification.

b) Provide dual overhead distribution busways with safety disconnects in shop areas for three phase, 115/200 V, 400 Hz and three phase, 120/208 V, 60 Hz conforming to NAVAIR 01-1A-512.

A separately derived three phase, 120/208 V, four wire, 60 Hz feeder circuit supplied by a dedicated transformer bank should be provided to serve the branch circuit panel which supplies only the overhead busways for the automatic test equipment (ATE).

c) The 400 Hz power supplies should be regulated to eliminate error in the calibration of equipment. Refer to MIL-STD-704, Aircraft Electrical Power Characteristics, and MIL-STD-1399-300, Interface Standard for Shipboard Systems Section 300A Electric Power, Alternating Current, for 400 Hz power requirements. NFGS 16268 provides criteria for 400 Hz static inverter systems.

d) 28 V direct current power should be provided by NEB-2 workbenches in shop areas. Any 28 Vdc requirement that cannot be facilitated by a NEB-2 should be provided for by transformer rectifier. Refer to MIL-STD-704 for 38 V direct current power requirements.

e) A power room should be provided to house the equipment for generating 400 Hz power, a master output power panel (MOPP), and ventilation equipment. No other mechanical equipment is to be housed in the power room. Refer to NAVAIR 01-1A-512 for further information on the requirements of the power room.

f) An auxiliary power input box should be mounted on the outside wall of the shop to allow the connection of an aircraft ground support electrical power cart to be used to generate shop power in the event of a power failure. Refer to NAVAIR 01-1A-512 for further information on the auxiliary power requirements.

g) An uninterruptible power supply should be provided whenever computer based automated test equipment is installed. This unit should provide backup power of sufficient load to allow proper shut down of the automated test equipment in the event of a power failure. If this unit uses lead-acid style batteries, it may be housed in the lead-acid battery room.

9.5.3 Lighting. Lighting should conform to the following criteria:

a) Interior lighting should normally be energy efficient fluorescent, in accordance with ASHRAE 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings, except that only incandescent lighting should be provided in the ECM/Crypto Repair Room.

b) Exterior lighting should be high-pressure sodium vapor where practical.

c) Design for lighting intensities should be in accordance with MIL-HDBK-1190.

9.5.4 Grounding. Two separate grounding systems should be provided. One system is for grounding the building structure, service entrance, and normal building equipment. The second grounding system is an insulated conductor single point grounding grid system for grounding the instruments and ATE in shop areas. The single point ground must be verified and maintained to less than one ohm resistance to ground for optimum ATE operation.

9.5.5 Communications. A communications system outlet should be provided in the production control office for connection to the IMA offices. Refer to par. 1.8. An intercommunications system should be provided between production control, each room in the Avionics Building, and each shop in the main work center area. Telephone access should be provided to each branch as outlined in par. 9.1 and to production control, the supply support area, and all offices in the administrative area.

9.6 Security. The entire building should be designed for controlled access. Only the production control office, PME/FCA receipt and issue room, and the administrative offices should be readily accessible from the outside. Entrance to the remainder of the shops should require passing through a security checkpoint. The ECM room should meet the requirements for a classification of Secret, and the crypto repair room and vault should meet the requirements for a classification of Top Secret in accordance with OPNAV 5510.1 and OPNAV 5530.14. The ECM and crypto repair rooms must comply with DOD 5200.1 including the X0-7 Electronic Door Lock and Access Control System. Refer to MIL-HDBK-1013/1 for physical security construction criteria.

Section 10: AIRCRAFT BORESIGHT RANGE

10.1 Function. The aircraft boresight range should be designed to provide facilities for in-place bore sighting and firing in of guns built into or attached to aircraft.

10.2 Location. Two ranges, Type A (semi enclosed) and Type B (open) have different location criteria.

10.2.1 Type A Range. The Type A range should be located in close proximity to taxiways, but special care must be taken to ensure that no visual obstruction occurs between the tower and runways and taxiways. Due to noise generation and safety considerations, this facility should be separated from inhabited structures and the station boundary by a minimum distance of 1200 ft (366 m). Prevailing winds should also be considered for orientation and noise abatement.

10.2.2 Type B Range. In addition to the location criteria for the Type A range, the Type B range requires a danger zone area, 1700 yards (1555 m) wide by 7000 yards (6401 m) long.

10.3 Architectural and Structural Requirements. The architectural design should be in accordance with MIL-HDBK-1001/1, and the structural design should be in accordance with the criteria manual series on structural engineering. Both the Type A and Type B boresight ranges should have a length of 2000 inches (50.8 m) from the firing point of the aircraft to the target at the firing-in-butt. There should be no structural projections in the tunnel of the Type A range, and all lighting fixtures, fixed ladders, mechanical equipment, and target maneuvering equipment should be recessed. The Type B range, with the addition of the danger zone, should be similar to the Type A range, except that the tunnel portion and the exhaust system should be deleted. This would leave only the tiedown and turnaround pad, access pavements, and the firing-in-butt.

10.3.1 Tunnel. The walls and ceiling of the boresight tunnel portion should be of 12 inch (304.8 mm) thick reinforced concrete. The entire area of the tunnel need not have a concrete floor, but should be center paved to allow trucks and loaders to travel to the firing-in-butt for maintenance and

changing of sand. Full-height, chain-link fence gates should be provided across the tunnel entrance. The gates should be designed so that the tunnel entrance is completely free of obstructions when the gates are open for firing.

10.3.2 Firing-in-Butt. The floor slab at the firing-in-butt portion should be reinforced concrete with a minimum thickness of 6 inches (153 mm). In the butt area, the sidewalls, ceiling, and upper half of the rear wall should be lined with 4 in. (102 mm) thick timber. On the Type B range, the edges of the walls and the ceiling facing the aircraft should be faced with 12 inches (305 mm) minimum thickness timber, fastened in such a way that there is no metal facing the firing line. Four-foot (1.2 m) square openings with watertight hatch covers should be provided in the roof over the butt area for sandfill access.

10.3.3 Target System. The target system should consist of a movable target easel, in which the trolley mechanism for positioning targets horizontally is recessed in the floor and the ceiling. The pulley mechanism for vertical positioning should be recessed in the sidewalls. Adjacent to the target area, on each side of the tunnel, a fixed steel ladder should be recessed in the wall for maintenance and target changing.

10.3.4 Wing Rooms. Rooms should be provided on both sides of the firing-in butt target area of the Type A range only. The wing rooms should serve as safe areas in which personnel may take refuge while sighting-in and firing occurs. The rooms should also serve as a spare target storage area, a hook-up for direct communications to the firing line and the aircraft, and a control station for target light and ventilation equipment. The wing rooms should have 8 inch (203 mm) thick reinforced concrete or CMU walls and an 8 inch (203 mm) thick precast or cast-in-place reinforced concrete roof. Cells of CMU walls should be grout filled in Seismic Zones 3 and 4. Exterior openings of wing rooms should be provided with chain-link fence gates fitted with panic hardware locks for emergency exit.

10.3.5 Shelters. Shelters should be designed to meet the following criteria:

a) Adjacent to the tiedown and turnaround pad near the tunnel entrance, a shelter should be provided at the electrical service points for protection and storage of electrical gear and power serviceables.

b) A standard 12- by 20-foot (3.6 by 6.1 m) line shelter should be provided near the rear portion of the tiedown and turnaround pad for crew shelters and storage of jacks and tiedown gear (refer to Section 12 for line shelter criteria).

10.3.6 Exterior Pavement. The taxiway and turnaround pad should be designed as an aircraft parking apron for the critical using aircraft, in accordance with MIL-HDBK-1021/2 and MIL-HDBK-1021/4, except that tiedowns should be provided on 10 foot (3.05 m) centers. Access pavements to the line shelter and the firing-in-butt should be as called for in NAVFAC DM-5.04.

10.4 Mechanical Requirements. The mechanical requirements for the aircraft foresight range should conform to the criteria in pars. 10.4.1. through 10.4.3.

10.4.1 Heating and Air Conditioning. Heating and air conditioning are not required for this facility.

10.4.2 Ventilation. Ventilation should be in accordance with MIL-HDBK-1003/3. Exhaust fans should be provided above the firing-in-butt portion of the range, to cause air to flow across the target area at the rate of 7.5 cfm (0.004 cubic meter) per square foot (0.09 square meter) of range tunnel floor area. Ventilation should also be in accordance with Lead Exposure and Design Considerations for Indoor Firing Ranges, Thomas L. Anania and Joseph A. Seta.

10.4.3 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01 and as follows:

a) Floor drains should be provided at the tunnel entrance to remove wind-driven rain.

b) The floor trench containing the trolley mechanism should be provided with drains to remove sprinkler system water.

c) A chemical toilet should be provided in the line shelter unless a sanitary sewer is located nearby.

10.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/4 and defined in pars. 10.5.1 through 10.5.4.

10.5.1 Power Outlets. Power outlets should conform to the following:

a) Two single-phase, 120 V, 20 ampere, 60 Hz convenience outlets should be provided in each wing room and electrical service points shelters.

b) Single-phase, 120 V, 20 ampere, 60 Hz power outlets should be provided in the line shelter for convenience and electric heaters.

c) Three-phase, 115/200 V, 400 Hz, and 28 V direct current power outlets should be provided in the electrical service points shelter to run the aircraft systems. Ampacity of the power outlets should be as required by the using agency for the specific facility. Refer to MIL-STD-704 and MIL-STD-1399-300 for 400 Hz power requirements and refer to MIL-STD-704 for 28 V direct current power requirements.

10.5.2 Lighting. Lighting should conform to the following:

a) The Type A range should be lighted to provide an intensity of 50 footcandles over the entire target face. Ceiling floodlights that light the target face should be vertically and horizontally adjustable.

b) Lighting for the tunnel portion should be provided at an intensity of 2 footcandles to allow safe passage in the tunnel.

c) Exterior lighting should be in accordance with MIL-HDBK-1023/1, Airfield Lighting. Floodlights should be provided to light the entire tiedown and turnaround pad.

10.5.3 Grounding. Two flush-ground receptacles, each with a 3/4-inch (19 mm) diameter ground rod, should be provided in the tiedown pad. The resistance to ground should be 25 ohms maximum. Bond ground receptacles together with No. 4 AWG bare copper in or below the tiedown pad.

10.5.4 Communications. A two-way communications system should be provided that consists of headsets with land wiring direct between the firing-in-butt and the pilot's seat via a plug-in in the aircraft fuselage. Due to proximity of the flight line and taxiways, the headsets should provide ear protection from medium- to high-level noise and should consist of a noise-shielded microphone. Sound-powered phones and walkie-talkies should not be used.

10.6 Safety Requirements. Both types of ranges should be provided with flashing warning lights on each side of the facility, a danger flag, and a siren at the firing line to indicate firing in progress. Additionally, the Type B range and its entire danger area should be enclosed with a chain-link fence topped with three strands of barbed wire. Gates should be erected at the entrance and exit of station roads which cross over the danger zone. A danger flag should be furnished and erected at each gate. Warning signs showing "Danger" and "U.S. Government Property" should be spaced at a maximum of 500 feet (152 m) along the fence line. Refer to NAVFAC DM-5.12, Fencing, Gates, and Guard Towers, for fencing criteria.

Section 11: AIR-LAUNCHED GUIDED MISSILE SHOP

11.1 Function. The Air-Launched Guided Missile Shop should be designed to provide space for the receipt of such missiles as SHRIKE, SIDEWINDER, SPARROW, WALLEYE, and PHOENIX from a naval weapons station (NWS). Ready-forissue weapons received from an NWS require only basic integrity testing at the shop. At the time of attachment to the aircraft, the "on aircraft" check and test equipment are utilized to validate the "GO" condition of the missile. Rejected units are repackaged and returned to the NWS for reprocessing. Repair of ejection racks is accomplished in the Aviation Armaments Shop.

11.2 Location. After the explosive limits for the facility have been determined, it should be located in accordance with prescribed quantity distance standards and the provisions of NAVSEA OP-5. Site approval for explosive safety is under the cognizance of NAVFACENGCOM in accordance with NAVFACINST 11010.44, Shore Facilities Planning Manual. For ready accessibility to missile storage, the facility should be located in or near the magazine area. Direct vehicular access between the facility and the arming and de-arming pad is required.

11.3 Architectural Requirements. The Air-Launched Guided Missile Shop should be designed as shown in the facility plates. The workbay and exterior loading area should be equipped with a 3000 pound (1361 kg) capacity, overhead monorail system mounted 8 ft (2.4 m) above the floor. Where climatic conditions warrant, the loading area should be covered and protected. The workbay may be finished with a chemically resistant urethane (CRU) reflective floor coating. The office and personnel area should be finished in accordance with MIL-HDBK-1001/2, and should include toilet and locker facilities for both male and female personnel. Physical security of the facility in terms of security fencing, perimeter lighting, and clear zones should be as required by OPNAVINST 5530.14 and OPNAVINST 5510.1.

11.4 Mechanical Requirements. The mechanical requirements for the Air-Launched Guided Missile Shop are defined in pars. 11.4.1 through 11.4.3.

11.4.1 Heating, Ventilating, and Air Conditioning. Heating, ventilating, and air conditioning, including humidity control,

should be provided throughout the shop spaces in accordance with MIL-HDBK-1003/3. Inside design temperature for shop spaces should be 78 degrees F plus 2 degrees (23.9 degrees C) with a relative humidity of 50 plus 5 percent for cooling and 65 degrees F (18.3 degrees C) for heating. Other spaces should be air conditioned or ventilated and heated in accordance with MIL-HDBK-1003/3.

11.4.2 Compressed Air. Low-pressure compressed air should be provided at 125 psi (862 kPa) in accordance with NAVFAC DM-3.05, with sufficient capacity to serve the monorail hoist (if an air-operated hoist is provided) and compressed air outlets for tools at the workbenches.

11.4.3 Plumbing. Plumbing should be provided in accordance with NAVFAC DM-3.01. An eyewash and deluge shower with drain should be provided.

11.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/4 and as defined in pars. 11.5.1 through 11.5.3.

11.5.1 Lighting. Lighting should conform to the following criteria:

a) Interior lighting should be energy efficient fluorescent.

b) Task lighting in the work area should be 70 footcandles at 3 feet (0.9 m) above the floor.

c) General lighting intensities should be in accordance with MIL-HDBK-1190.

d) Fixed emergency work lighting should be provided to permit completion of assembly of a missile during power outages.

e) Exterior lighting should be of the high-pressure sodium vapor type where practical.

11.5.2 Grounding. An automatic retracting ground reel should be provided in each work area.

11.5.3 Lightning Protection. Lightning protection should be provided in accordance with NAVSEA OP-5 requirements.

11.6 Security. The entire building should be designed for controlled access and should meet the requirements of OPNAVINST 5510.1, OPNAVINST 5530.14, and MIL-HDBK-1013/1.

11.7 Weight-Handling Equipment. The overhead monorail hoist should have a 3000 pound (1361 kg) capacity with either an air-operated (in accordance with NFGS-14535, Monorails With Air Motor Powered Hoist), or a sparkproof electric hoist and trolley motors. The hoist should be a wire rope type. Chain hoists should not be used, due to the possibility of the chain damaging missile components (refer to NAVFAC DM-38.01 for additional criteria).

Section 12: LINE SHELTER

12.1 Function. The line shelter is provided to support aircraft line operations and maintenance and may be used to support other functions that require a portable or permanent building. The shelter configured for line operations contains space for crew shelter and support facilities, and the shelter configured for line maintenance contains space for tiedown gear, pre expended material, and sheltered workspace. Shelters provided for other purposes should be configured as required.

12.2 Location. Line shelters should be located as close as possible to the working area of the personnel and aircraft they support.

12.3 Architectural Requirements. The architectural requirements for line shelters are defined in pars. 12.3.1 through 12.3.4.

12.3.1 Portable Line Shelters. The portable line shelter is a skid-mounted building of non-combustible material, with outside dimensions of 12 by 20 feet (3.66 by 6.1 m) and an interior floor-to-ceiling height of 8 feet (2.44 m). The shelter should not weigh more than 18,000 pounds (8165 kg) and should have the capability of being lifted as a unit. Integral lift points should be provided. Each building envelope should be insulated as required in par. 1.6. Each portable line shelter should be a pre-engineered panel frame metal building. Built-in bins, counters, and equipment (except lockers) should be provided as shown in the facility plates.

12.3.2 Permanent Line Shelters. The permanent line shelter should be an insulated pre-engineered metal building or of insulated CMU construction. Each permanent shelter should contain offices; storage; repair shop; and toilet, locker, and shower facilities for male and female personnel.

12.3.3 Noise Control. Due to their proximity to the flight line and apron, adequate acoustical insulation should be provided in each type of shelter to meet office requirements as set forth in NAVFAC DM-1.03.

12.3.4 Interior Finishes. Interior surfaces, including walls, floors, and ceilings should have easily maintained and cleaned finishes.

12.4 Mechanical Requirements. The mechanical requirements for line shelters are defined in pars. 12.4.1 and 12.4.2.

12.4.1 Portable Shelter. An electric, ceiling-mounted, variable-throw, forced-air space heater and a ventilating fan should be provided as required in accordance with MIL-HDBK-1003/3. A dry chemical toilet should also be provided.

12.4.2 Permanent Shelter. Heating and ventilation should be provided in accordance with NAVFAC MIL-HDBK-1003/3. Plumbing should be provided in accordance with NAVFAC DM-3.01.

12.5 Electrical Requirements. The electrical requirements for line shelters are defined in pars. 12.5.1 and 12.5.2.

12.5.1 Portable Shelter. A weatherproof, exterior, power receptacle should be provided for a plug-in, single-phase, 120 V, 60 Hz source from an apron service point or a portable generator. Two 20 ampere capacity convenience outlets should be provided on each wall. Ceiling, surface-mounted, electrical lighting fixtures should be provided for a minimum of 30 footcandles of light intensity at counter height.

12.5.2 Permanent Shelter. Electrical systems should be provided in accordance with MIL-HDBK-1004/4.

12.6 Communications. If practical, landline communications should be provided with the organizational hangar and communications tie-in. If not practical, provide for communications by two-way radio on designated frequencies (refer to par. 1.8). Communications to the flight line apron should be by loudspeaker.

Section 13: FLAMMABLE STORAGE FACILITIES ON THE FLIGHT LINE

13.1 Function. A flammable storage facility on the flight line should be provided for storage of paints, oils, cleaners, solvents, and other flammable or combustible materials being used in the hangars and aircraft maintenance shops, where adequate inside fire-resistive storage has not been provided.

13.2 Location. A flammable storage facility may be located adjacent to or in the vicinity of the hangar or shop that it supports.

13.3 Architectural Requirements. A flammable storage building located less than 50 feet (15.2 m) from an adjacent building should not have any opening in the wall facing the adjacent building. Any drainage from the flammable storage facilities should be away from the adjacent building. The building should be of metal panel construction. The floor and lower portion of the building walls should be liquid tight. Door openings should have liquid-tight raised sills or ramps at least 4 inches (102 mm) high. Ventilation openings should be located as low as feasible above sill height in doors and walls. Shelves 8 inches wide (203 mm) should be provided. Refer to NAVFAC P-272, Part 3, for a 450 square foot (41.8 square meter) ground support equipment shop, flammable storage facility, and for a 150 square foot (13.9 square meter) facility for a Marine Corps aircraft squadron.

13.4 Mechanical Requirements. Gravity exhaust ventilation should be provided in accordance with the requirements set forth in MIL-HDBK-1003/3.

13.5 Electrical Requirements. Electrical installations should be in accordance with NAVFAC DM-22, Petroleum Fuel Facilities, and NFPA 70.

Section 14: MARINE CORPS AIRCRAFT MAINTENANCE FACILITIES

14.1 Function. Marine Corps aircraft maintenance facilities encompass the functions of aircraft maintenance facilities for the Navy. However, Marine Corps facilities differ from Navy facilities as described in pars. 14.1.1 and 14.1.2

14.1.1 Maintenance Responsibilities. A Marine Corps air station may be assigned only limited intermediate maintenance level responsibility for its own aircraft. Intermediate level maintenance for Marine Corps aircraft squadrons is performed by a headquarters and maintenance squadron (H&MS). At a naval station, this maintenance is performed by an AIMD for aircraft based at the station. In a garrison situation, a Marine Corps aircraft group may be responsible for maintenance for as many as six or more squadrons.

14.1.2 Maintenance Facilities. The expeditionary nature of the Marine Corps air support mission requires that some aviation maintenance support equipment be configured for MFs which deploy with the group. Since it is not practical or economical to remove installed equipment from MFs or to duplicate this equipment in permanent facilities, Marine Corps aircraft maintenance in the continental United States must be a combination of permanent construction and the MF. Navy aircraft maintenance facilities, however, are usually permanent construction.

14.2 Location. Each Marine Corps intermediate level maintenance shop complex should be located in proximity to the air group hangars. Preferably, the shops should be located to the rear of the line of hangars as depicted in NAVFAC P-272, Part 3. The definitive drawing shows a hangar and shop complex for a typical Marine Corps air group.

14.3 Design Requirements. The design criteria contained in other sections of this handbook for maintenance hangars and intermediate level maintenance shops should apply to the maintenance hangars and intermediate level maintenance spaces and shops supporting a Marine Corps air group, except as modified herein. Refer to NAVFAC P-80 for adjustments in size requirements for permanent Marine Corps facilities.

14.4 Architectural and Civil Requirements. Where facilities are to house deployable personnel units, the floor plan and exterior perimeter walls of the permanent structure should be arranged to permit installation of one or more MFs. Provisions should be made to connect such MFs to the permanent work spaces with direct and level access. Standard MFs are planned to be 8 feet (2.44 m) wide, 20 feet (6.1 m) long, and 8feet (2.44 m) high. The average distance from the floor surface of the MF bed to the bottom of jacks is 30 inches (762 m). Two MFs may be placed close together side-by-side; however, a minimum distance of 10 feet (3.05 m) must be left between pairs of MFs for MF placement, removal, and servicing. Some MF complexes require end-to-end connections between MFs arranged in combinations up to four deep. The apron around the building where the MF will be located should be concrete pavement, in accordance with NAVFAC DM-5.04. The concrete apron should be wide enough to accommodate four MFs end-to-end. Additional aprons should be provided as necessary for convenient parking of MFs and access around the MF complex (refer to the manufacturer's manual covering the MF that will be utilized). Access from the building to the MF should be through watertight, weatherproof vestibules, closeable by fusible-link, actuated, rolling steel fire doors. These vestibules should be deep enough so that the doors of the initial MF are operable and do not interfere with the fire doors. Where MFs line exterior walls of the building, a personnel door should be provided to the exterior between every fourth MF series. Refer to NAVFAC P-272, Part 3, for definitive drawings showing shops configured for MF. Space should be provided near the facility for parking MF trailers, and enclosures should be provided for equipment required to service the MF.

14.5 Security. Depending upon the nature of the facility, consideration should be given to providing security fencing and lighting of the complex's perimeter and apron area. Refer to MIL-HDBK-1013/1 and MIL-HDBK-1013/11, Instruction for High Security Magazine Door Construction, for physical security and fencing requirements.

14.6 Mechanical Requirements. Mechanical design for the permanent portion of the facility should be as required by other sections in this handbook covering a similar type of facility not utilizing MFs (refer to Sections 5, 7, 8, 9, 10, and 15).

14.7 Electrical Requirements. Electrical design for the permanent portion of the facility should be as required by other sections in this handbook covering a similar type of facility not utilizing MF (refer to Sections 5, 7, 8, 9, 10, and 15). Additional requirements are defined in pars. 14.7.1 through 14.7.4.

14.7.1 Emergency Power. A power outlet should be provided on the outside of the permanent building structure for connection of an emergency, field-type generating unit to the building power loop. The power outlet should be of a capacity to handle the entire facility electrical power requirement and should be connected to the power system through a manual transfer switch. The transfer switch will permit operating the generating unit during the loss of the normal power source and will permit load testing of the unit.

14.7.2 400 Hertz Power. For facilities that require 400 Hz power (refer to Sections 5, 8, and 10), a permanent source of 400 Hz power should be provided for the facility, even though a portable unit is used for the MF complex, so that this power will be available at the permanent facility when the portable unit is deployed. Voltage regulation should be provided when required by the work performed in some MFs. Energy efficient solid-state frequency converters should be used. NFGS-16268 provides specifications.

14.7.3 Power Outlets. Power outlets should be provided on the outside of the building at each opening for MF. The voltage and phase of the outlets should be as required by the particular facility and the ampacity should be sufficient to supply four MFs end-to-end. Outlets should be adaptable to the plugs provided with the MF in accordance with Military Specification MILC-22992, Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type.

14.7.4 Communications. A plug-in intercommunications system between the production control office and each series of MFs should be provided at the building perimeter.

Section 15: MARINE CORPS AIRCRAFT GROUP AVIATION SUPPLY SUPPORT CENTE

15.1 Function. A Marine Corps Aircraft Group Aviation Supply Support Center (GASSC) provides administrative, material handling, and storage spaces for Marine Corps aircraft group supply functions and the handling and storage of Navy and Marine Corps material and property assigned to the group.

15.2 Location. The GASSC building and the open storage area should be located within the intermediate level maintenance shop complex in proximity to the Marine Corps aircraft group hangars. Consideration should be given to placement of MF adjacent to the building and to unobstructed access from each maintenance shop and base supply. The preferred location of the GASSC administrative bay is adjacent to the Marine Corps Aircraft Group Headquarters Building (refer to NAVFAC P-272, Part 3).

15.3 Architectural Requirements. The GASSC should be a pre-engineered insulated metal building. Rooms and areas should be provided as depicted in NAVFAC P-272, Part 3, and as defined in pars. 15.3.1 through 15.3.3.

15.3.1 Spaces. Space within the GASSC should conform to the criteria in pars. 15.3.1.1 through 15.3.1.4.

15.3.1.1 Administrative. Administrative spaces should be subdivided with movable partitions and should contain provisions for convenient location of office machines.

15.3.1.2 Security Area. A security area, a pre-expended bin storage room, and a small flammable storage room should be constructed of solid CMUs of 8-inch (203 mm) minimum thickness. Refer to NFPA 30, Flammable and Combustible Liquids Code, for construction criteria for flammable storage.

15.3.1.3 Receiving and Issue and Supply. Receiving and issue and supply screening functions should be located in the vicinity of the building entrance and enclosed by 4 foot high (minimum) movable partitions that offer optimum surveillance of entrances.

15.3.1.4 Interior Storage. Interior storage areas should be subdivided by full-height, chain-link fencing.

15.3.2 Building Access. Access to the GASSC should be as follows:

a) Provide for permanent controlled access from the building to small parts MF. Refer to Section 14 for criteria covering Marine Corps aircraft maintenance facilities.

b) Access to the building from the loading dock and ramp should be by rollup doors.

15.3.3 Building Protection. Interior columns and partitions should be protected against impact by materials handling equipment.

15.4 Mechanical Requirements. The GASSC should conform to the criteria defined in pars. 15.4.1 through 15.4.4.

15.4.1 Heating and Ventilation. Heating and ventilation should be provided in the administrative, material handling, and storage spaces in accordance with MIL-HDBK-1003/3.

15.4.2 Air Conditioning. Air conditioning should be provided for the administrative spaces in accordance with MIL-HDBK-1003/3.

15.4.3 Plumbing. Plumbing should be in accordance with NAVFAC DM-3.01.

15.4.4 Noise and Vibration Control. Mechanical systems and equipment should be designed to limit noise and vibration in accordance with NAVFAC DM-3.10.

15.5 Electrical Requirements. Electrical systems should be provided in accordance with MIL-HDBK-1004/4 and pars. 15.5.1 through 15.5.3.

15.5.1 Power Outlets. Single-phase, 120 V, 20 ampere, 60 Hz convenience outlets should be provided in all spaces.

15.5.2 Lighting. Lighting should conform to the following:

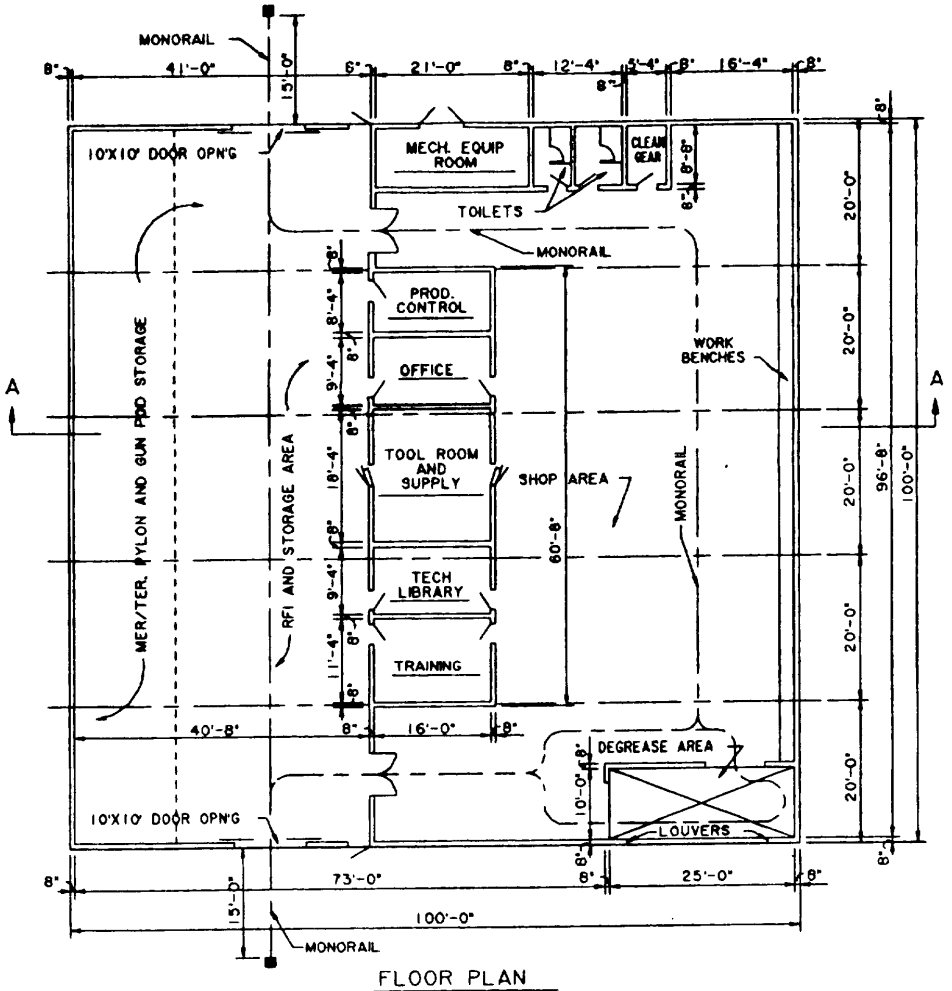
a) Interior lighting should normally be energy efficient fluorescent.

b) Exterior lighting should be high-pressure sodium vapor where practical.

c) Design lighting intensities should be in accordance with MILHDBK-1190.

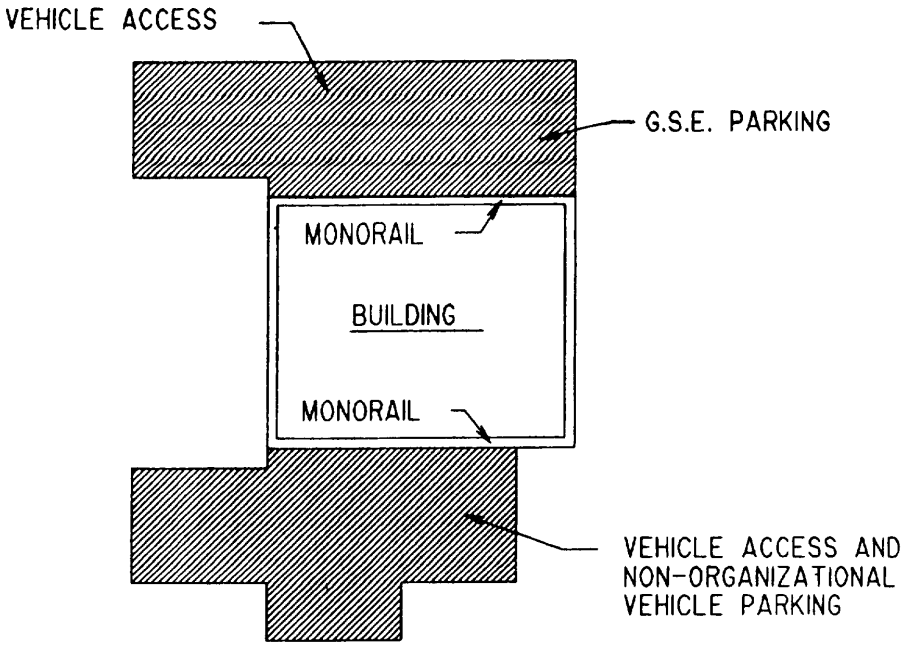
15.5.3 Communications. Internal communications should be provided.

NOTE: MONORAIL 2000 LB. CAP



FLOOR PLAN
NOT TO SCALE

TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 2 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	50 G.P.M.
HOT WATER	
RECOVERY RATE (100°RISE)	30 G.P.H.
STORAGE	30 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
294	252	210	168

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

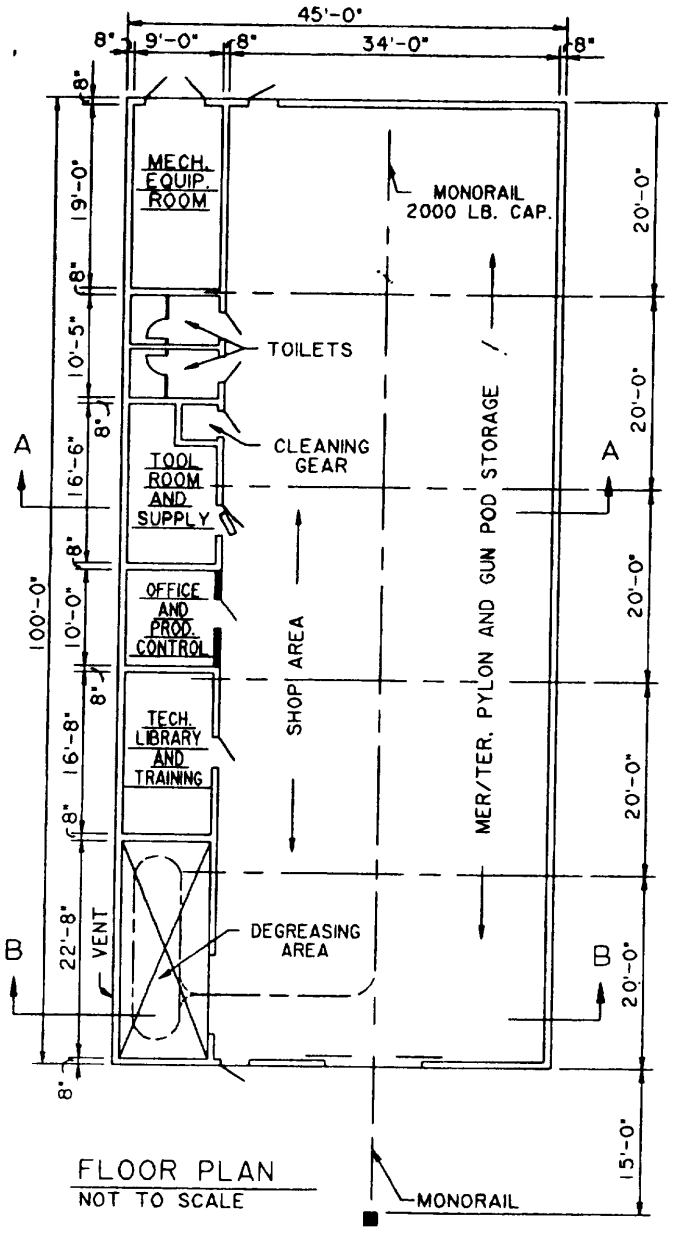
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	18.4
ESTIMATED DEMAND	14.2
POWER	
CONNECTED LOAD	120.0
ESTIMATED DEMAND	96.0
TOTAL	
CONNECTED LOAD	138.4
ESTIMATED DEMAND	110.2
AIR CONDITIONING	TO BE DETERMINED

AREAS

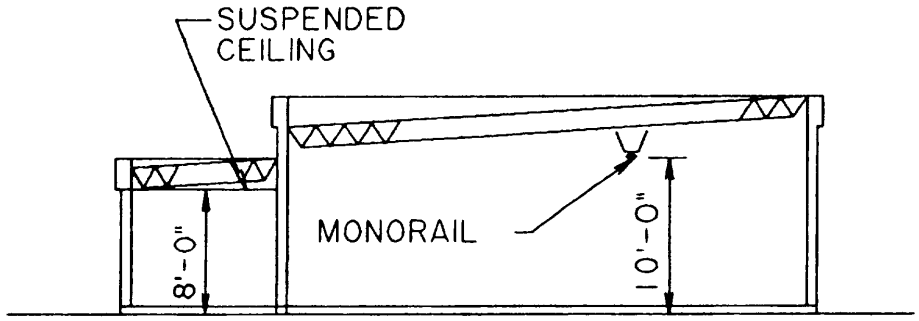
GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM 10,000 S.F.

TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 3 OF 3

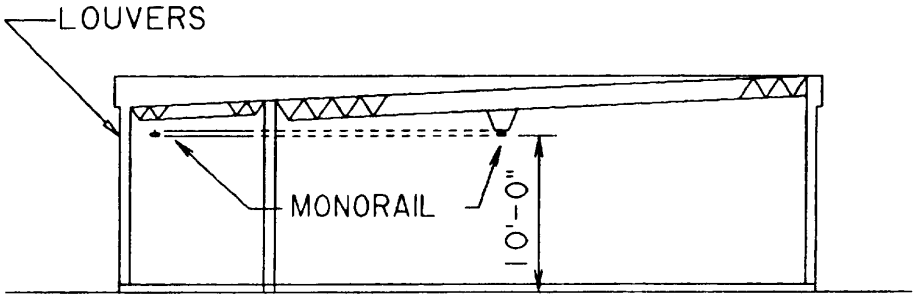


FLOOR PLAN
NOT TO SCALE

TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 1 OF 4

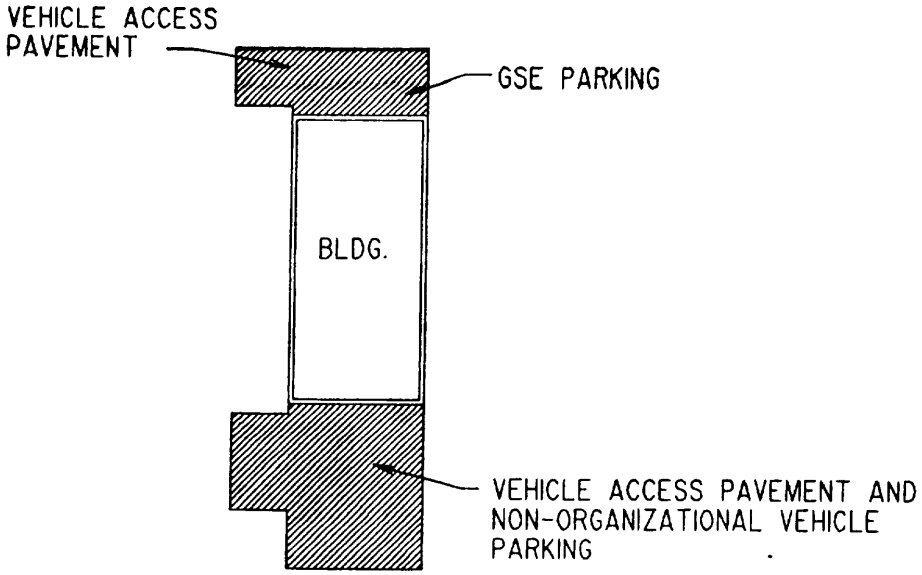


SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE

TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 2 OF 4



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 3 OF 4

NOTES

PLUMBING REQUIREMENTS

COLD WATER 50 G.P.M.

HOT WATER

RECOVERY RATE (100° RISE) 30 G.P.H.

STORAGE 30 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
210	180	150	120

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBTU/HR)

ELECTRICAL REQUIREMENTS (KW)

LIGHTS

CONNECTED LOAD 16.2

ESTIMATED DEMAND 12.6

POWER

CONNECTED LOAD 18.0

ESTIMATED DEMAND 14.4

TOTAL

CONNECTED LOAD 34.2

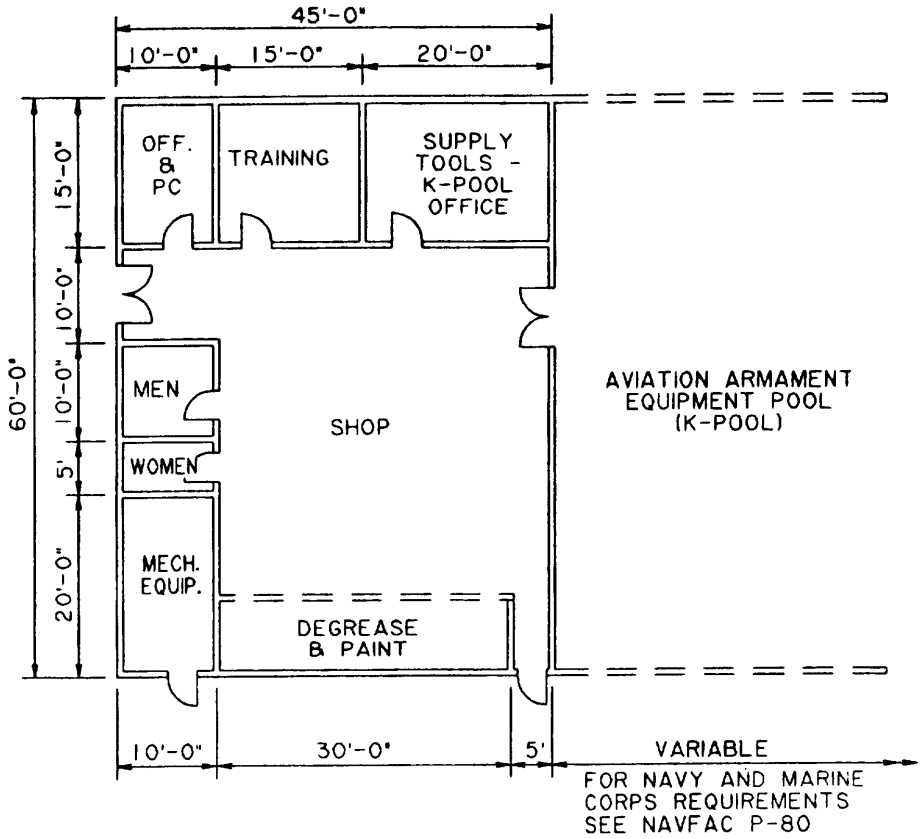
ESTIMATED DEMAND 27.0

AIR CONDITIONING TO BE DETERMINED

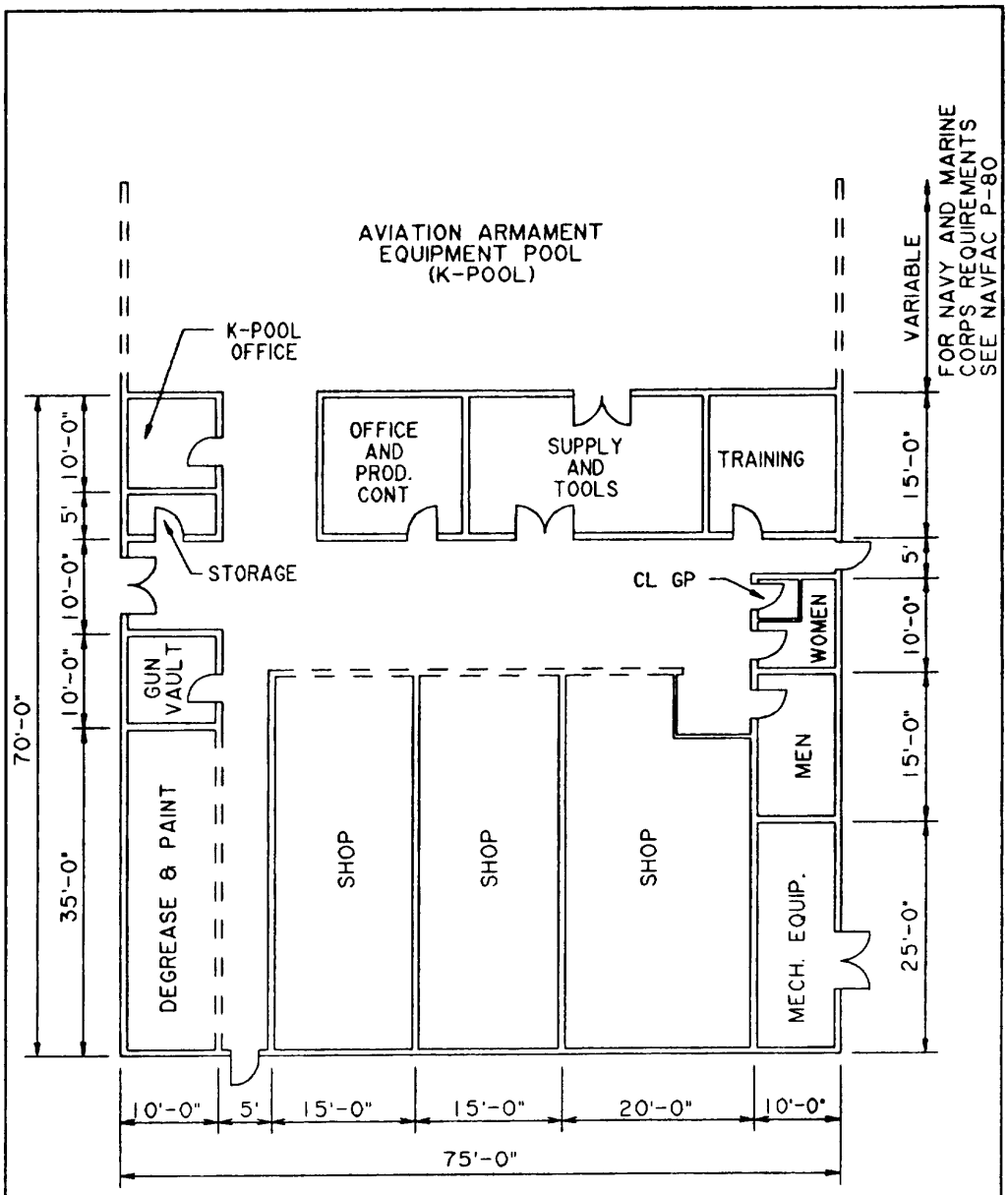
AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM 4,500 S.F.

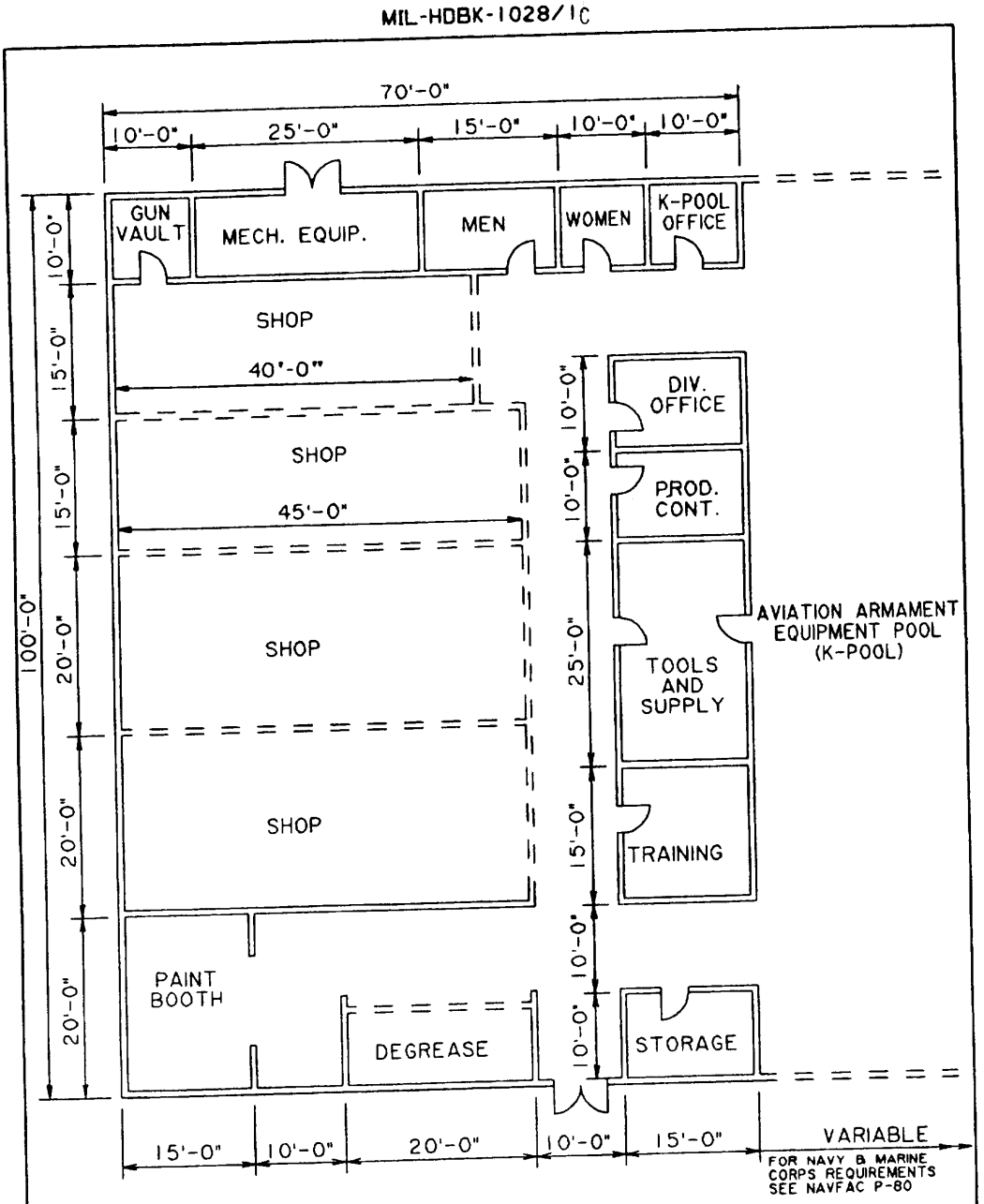
TITLE: AVIATION ARMAMENT SHOP	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 4 OF 4



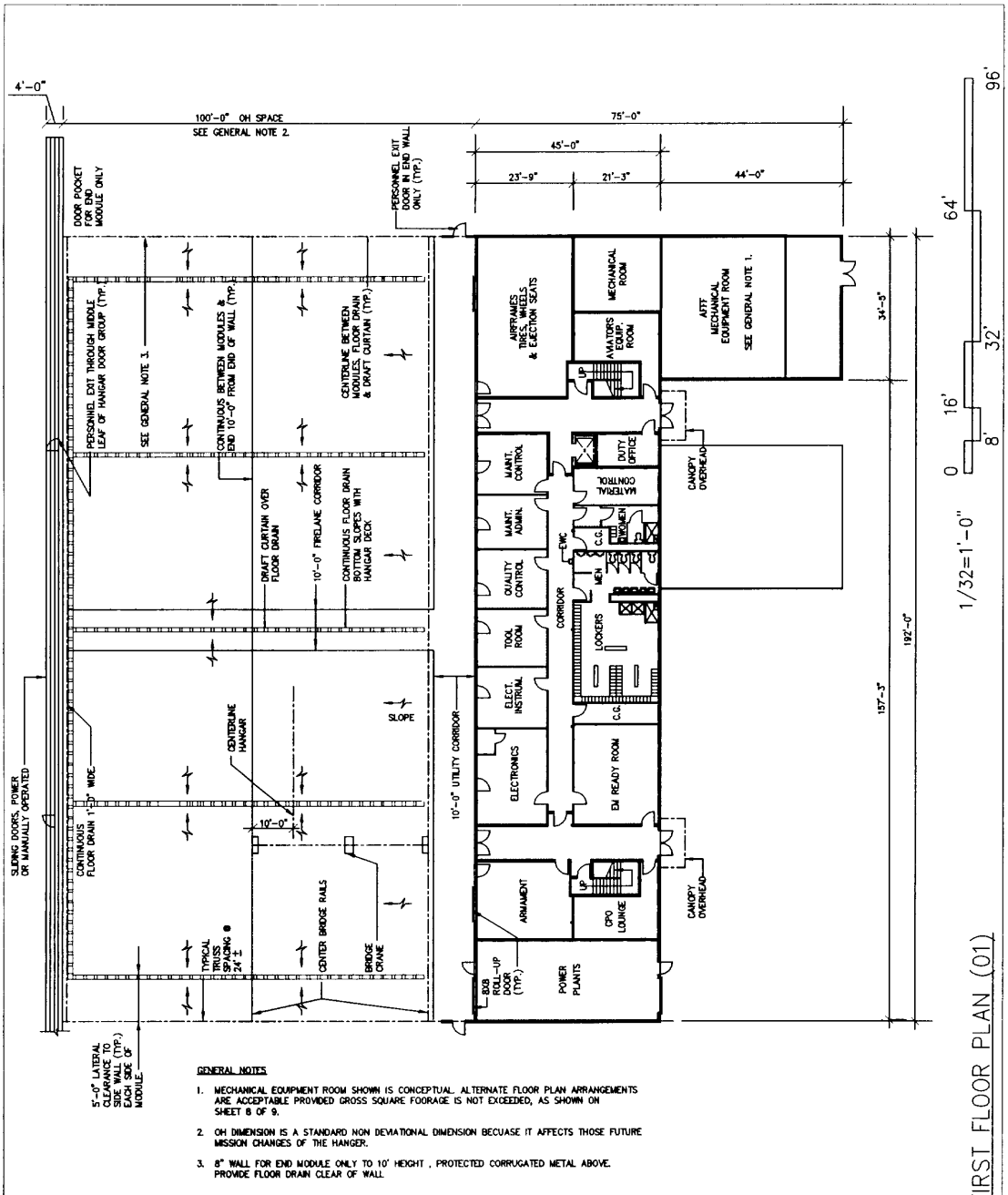
TITLE: AVIATION ARMAMENT SHOP - SMALL	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 1 OF 1



TITLE: AVIATION ARMAMENT SHOP - MEDIUM	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 1 OF 1



TITLE: AVIATION ARMAMENT SHOP - LARGE	DATE 03/91	FACILITY PLATE NO. 211-54	SHEET 1 OF 1

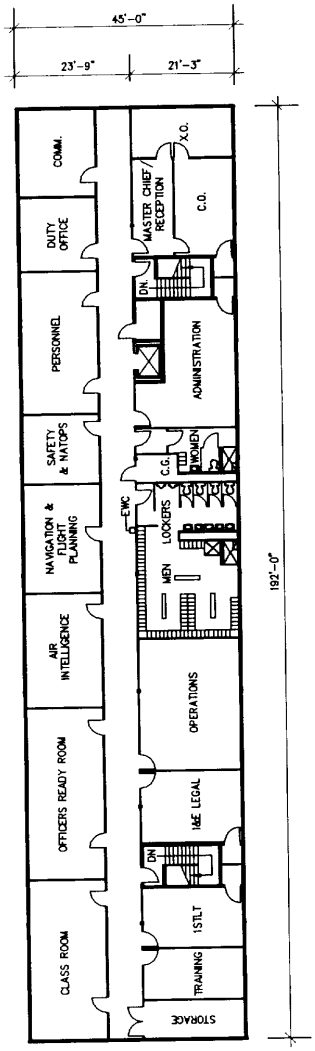


FIRST FLOOR PLAN (01)

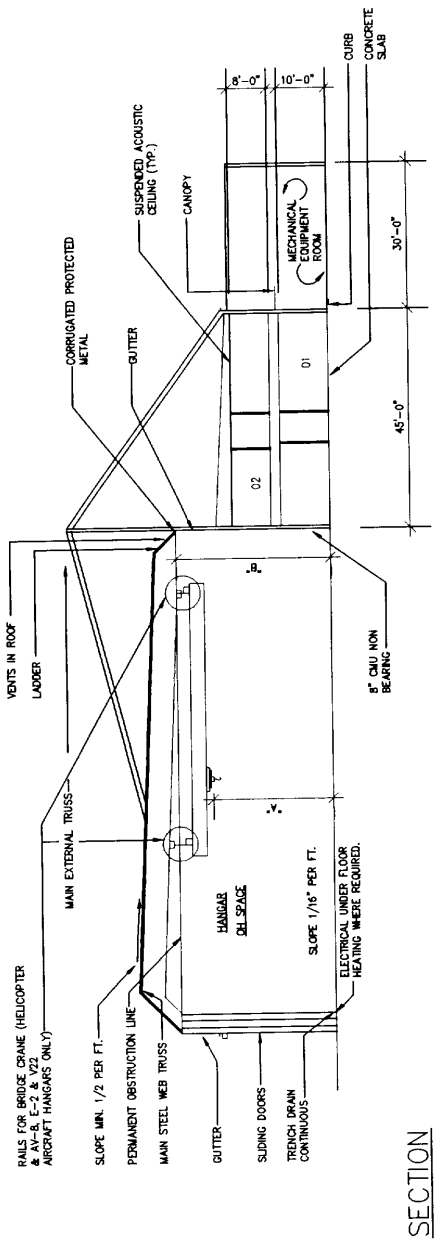
GENERAL NOTES

1. MECHANICAL EQUIPMENT ROOM SHOWN IS CONCEPTUAL. ALTERNATE FLOOR PLAN ARRANGEMENTS ARE ACCEPTABLE PROVIDED GROSS SQUARE FOORAGE IS NOT EXCEEDED, AS SHOWN ON SHEET 8 OF 9.
2. OH DIMENSION IS A STANDARD NON DEVIATIONAL DIMENSION BECUASE IT AFFECTS THOSE FUTURE MISSION CHANGES OF THE HANGER.
3. 8" WALL FOR END MODULE ONLY TO 10' HEIGHT , PROTECTED CORRUGATED METAL ABOVE. PROVIDE FLOOR DRAIN CLEAR OF WALL

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
MAINTENANCE HANGAR TYPE I	6/98	211-05/06/07	1 OF 9



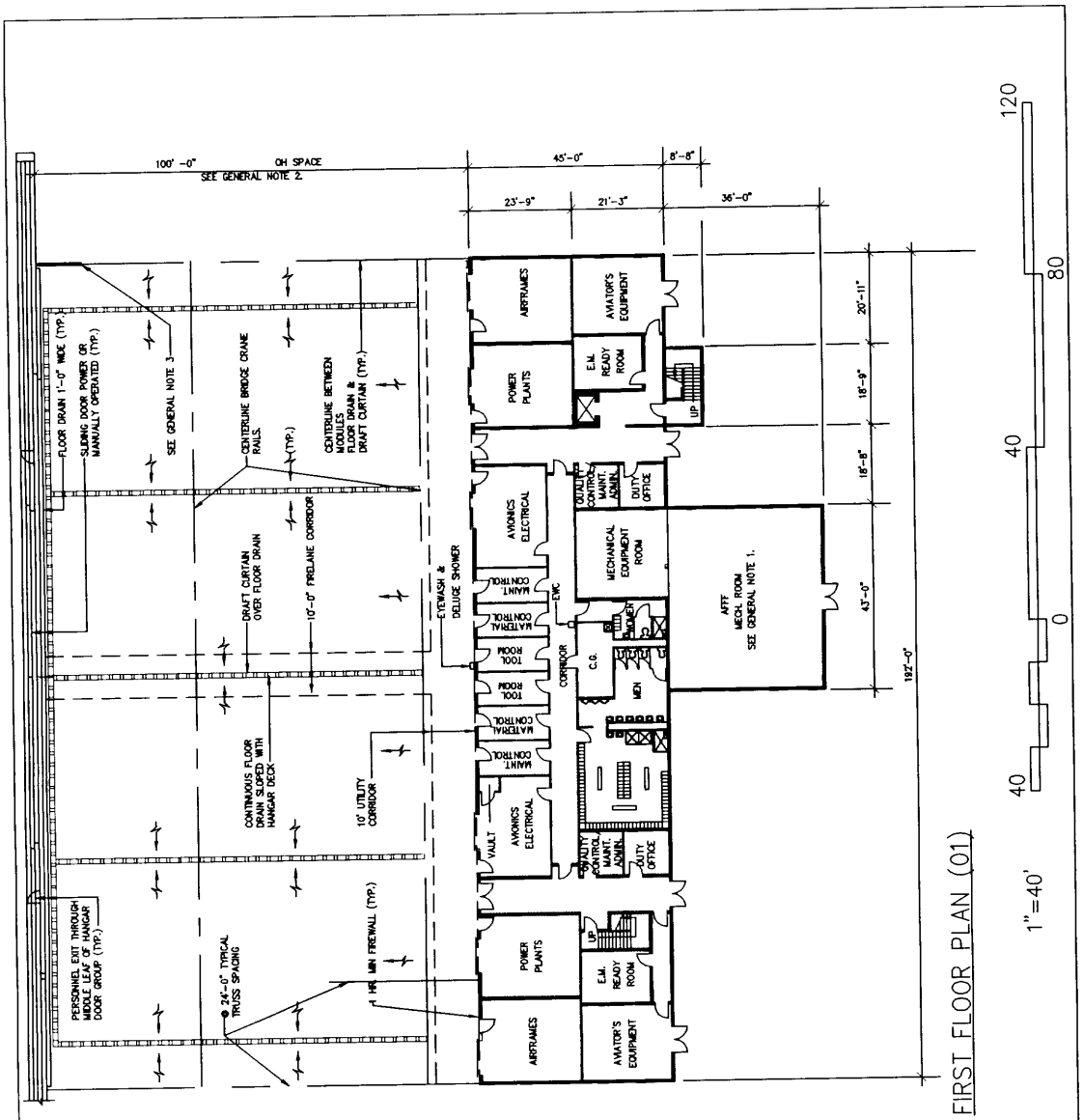
SECOND FLOOR PLAN (02)



SECTION

AIRCRAFT	"A"	"B"
STANDARD TYPE I	25' - 0"	32' - 8"

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
MAINTENANCE HANGAR TYPE I	6/98	211-05/06/07	2 OF 9



FIRST FLOOR PLAN (01)

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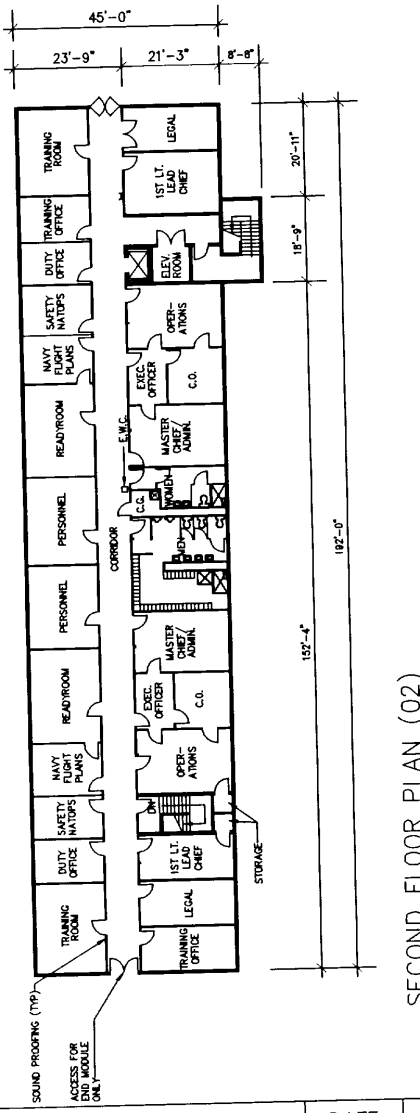
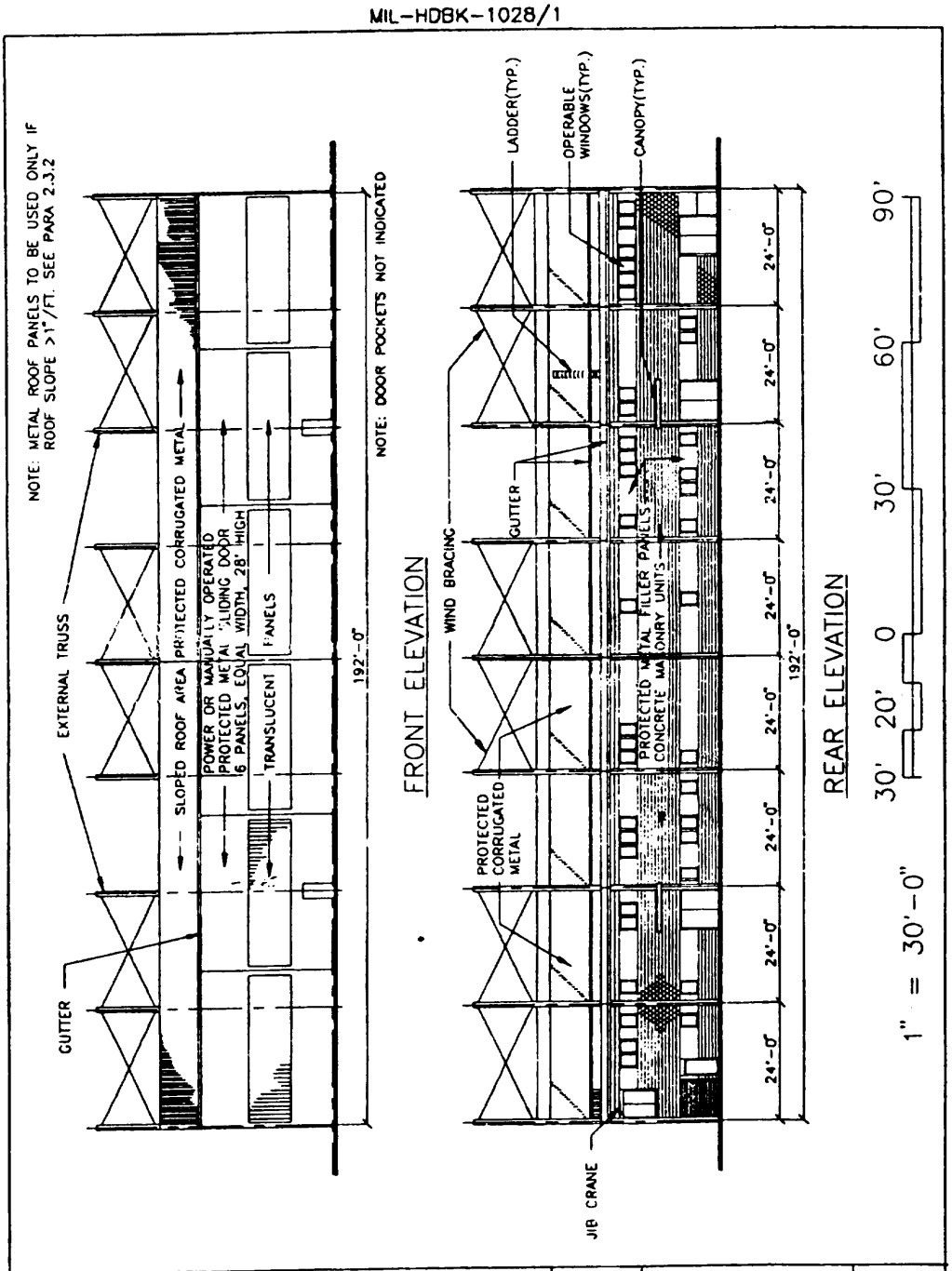
2. OH DIMENSION IS A STANDARD NON DEVIATIONAL DIMENSION BECUASE IT AFFECTS THOSE FUTURE MISSION CHANGES OF THE HANGER.
3. 8" WALL FOR END MODULE ONLY TO 10' HEIGHT, PROTECTED CORRUGATED METAL ABOVE. PROVIDE FLOOR DRAIN CLEAR OF WALL

TITLE: MAINTENANCE HANGAR TYPE I CONFIGURED FOR TWO CARRIER AEW SQUADRONS	DATE: 6/98	FACILITY PLATE NO.: 211-05/06/07	SHEET: 3 OF 9

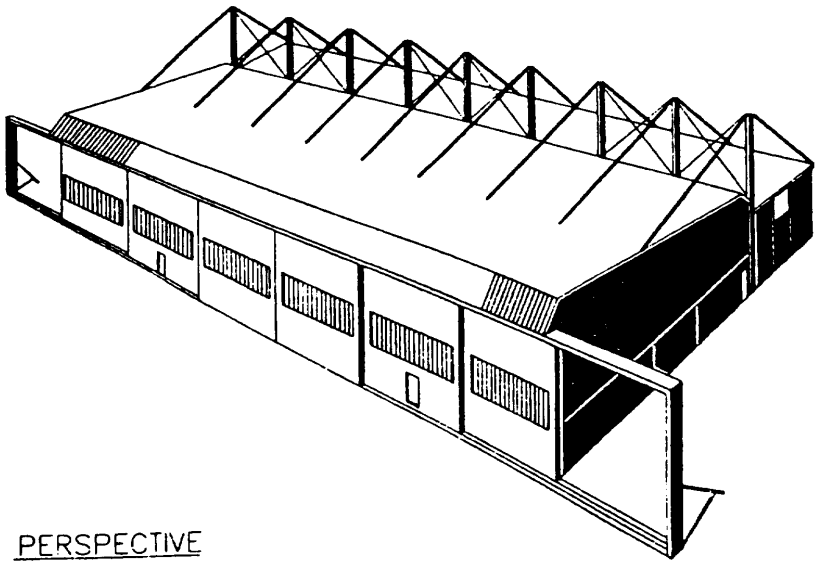


SECOND FLOOR PLAN (02)

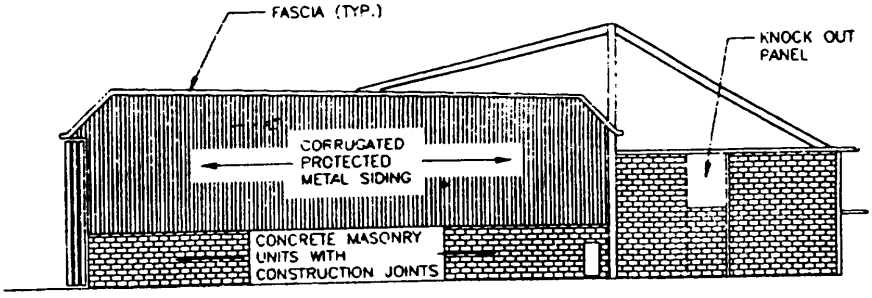
TITLE: MAINTENANCE HANGAR TYPE I CONFIGURED FOR TWO CARRIER AEW SQUADRONS	DATE: 6/98	FACILITY PLATE NO.: 211-05/06/07	SHEET: 4 OF 9



TITLE: MAINTENANCE HANGAR TYPE I	DATE	FACILITY PLATE NO.	SHEET
	03/91	211-05/06/07	5 of 9



PERSPECTIVE

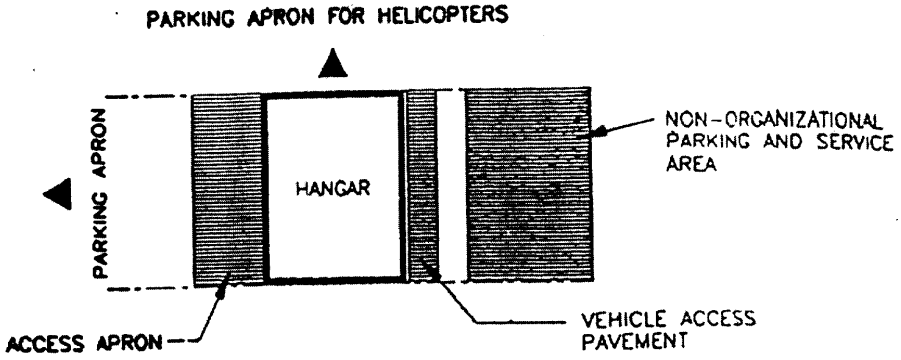


SIDE ELEVATION

1" = 30'-0"

30' 20' 0 30' 60' 90'

TITLE: MAINTENANCE HANGAR TYPE I	DATE 03/91	FACILITY PLATE NO. 211-05/06/07	SHEET 6 of 9



TYPICAL SITE PLAN
SCALE : NONE

THE ARRANGEMENT AND FUNCTIONAL LAYOUT INDICATED SHALL BE FOLLOWED UNLESS PRIOR CLEARANCE FOR CHANGE IS OBTAINED FROM THE NAVAL FACILITIES ENGINEERING COMMAND.

THE ARCHITECTURAL TREATMENT, MATERIALS, FRAMING AND CONSTRUCTION MAY VARY.

UTILITIES REQUIREMENTS INDICATED ARE FOR ESTIMATING PURPOSES ONLY.

GENERAL NOTES:

- IF THE NUMBER OF WOMEN TO BE ASSIGNED IS UNKNOWN, PROVIDE AS A MINIMUM THE TOILET FACILITIES INDICATED ON THE DRAWING.
- FOAM CONCENTRATE TANKS PROPORTIONING EQUIPMENT, FIRE PUMPS AND SPRINKLER VALVES SHALL BE LOCATED IN THE MECHANICAL EQUIPMENT ROOM.
- THE DIMENSIONS OF THE OH SPACE SHOULD BE MODIFIED AS APPROPRIATE TO ACCOMMODATE OVER-SIZE AIRCRAFT SUCH AS THE CH-53E .
- MINIMUM CEILING HEIGHT INDICATED IN OH SPACE.
- HOOK HEIGHT FOR BRIDGE CRANE(IF REQUIRED) SHOULD BE A MINIMUM OF 25'-0" ABOVE FINISHED FLOOR.

TITLE: MAINTENANCE HANGAR TYPE I	DATE	FACILITY PLATE NO.	SHEET
	03/91	211-05/06/07	7 of 9

PLUMBING REQUIREMENTS

COLD WATER	90 G.P.M.
HOT WATER (01-02 SPACE)	
RECOVERY RATE (100°F RISE)	350 G.P.H.
STORAGE	400 GAL.

FIRE PROTECTION REQUIREMENTS

WATER DEMAND	
FOAM-WATER SPRINKLER SYSTEM	3961 G.P.M.
OSCILLATING NOZZLES	1000 G.P.M.
HOSE STREAMS	500 G.P.M.
TOTAL FIRE PROTECTION DEMAND	5461 G.P.M.

HEATING REQUIREMENTS (MBH)*

*BASED ON NORFOLK, VIRGINIA AREA

INSIDE DESIGN TEMPERATURES		
OH SPACE	60°F	
01-02 SPACE	68°F	
OUTSIDE DESIGN TEMPERATURE		22°F
HEATING LOAD		
OH SPACE		975 MBH
01-02 SPACE		229 MBH

AIR CONDITIONING REQUIREMENTS*

INSIDE DESIGN TEMPERATURE	76°F D.B.
INSIDE DESIGN HUMIDITY	50%
OUTSIDE DESIGN TEMPERATURE	91°F D.B.
OUTSIDE DESIGN TEMPERATURE	77°F W.B.
COOLING LOAD, 01-02 SPACES	500 MBH

(EXCLUDING MECH RM., PASSAGES, STAIRS, TOILETS, POWER PLANTS, AVIATORS EQ. & AIR FRAMES)

ELECTRICAL REQUIREMENTS (KW)

	OH SPACE	01-02 SPACE
LIGHTS		
CONNECTED LOAD	38	61
ESTIMATED DEMAND	38	61
POWER		
CONNECTED LOAD	837	208
ESTIMATED DEMAND	419	104
TOTAL		
CONNECTED LOAD	875	269
ESTIMATED DEMAND	457	165
ADDITIONAL DEMAND FOR AIR CONDITIONING		54

AREAS (SQUARE FEET)

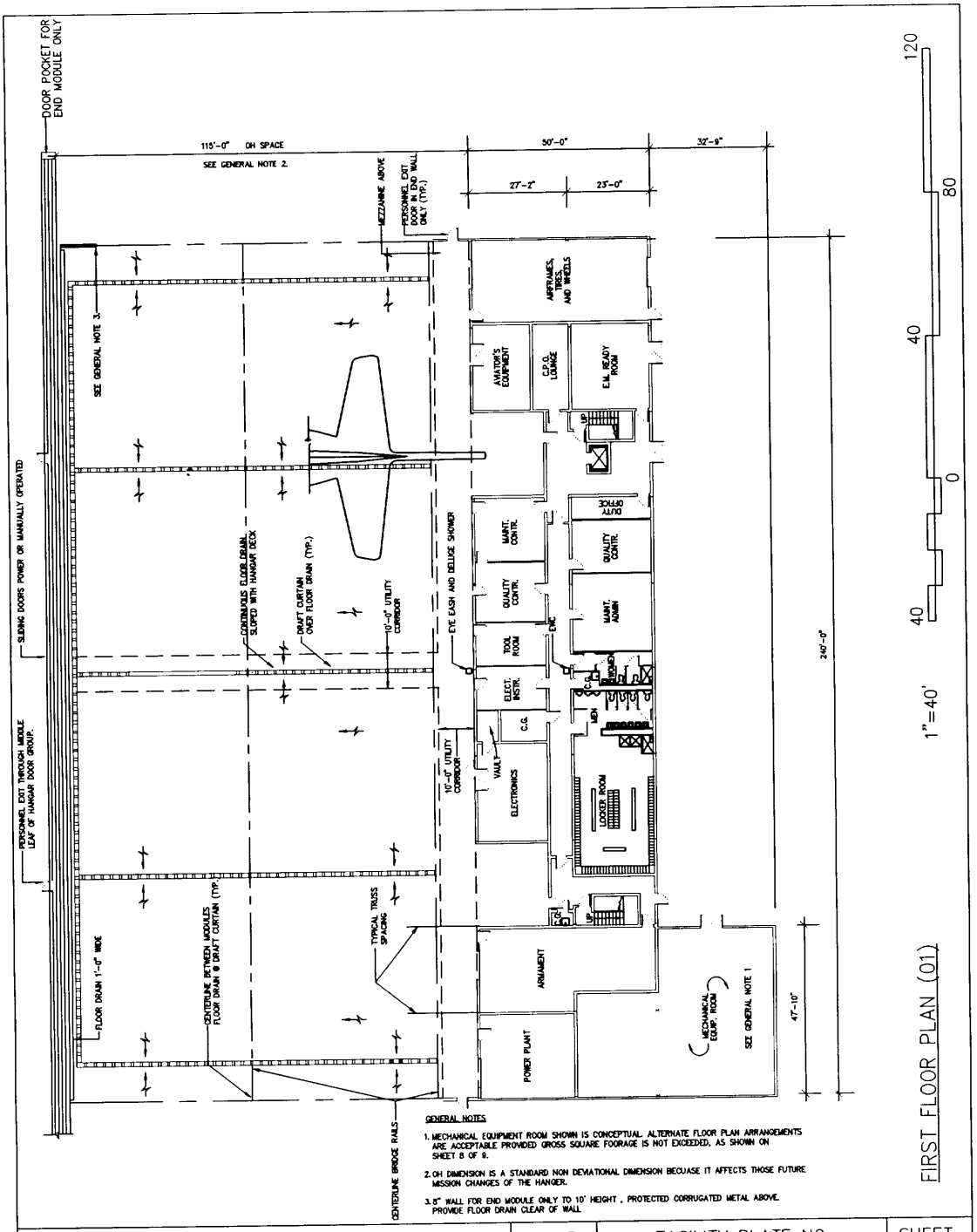
Standard TYPE I & TYPE I for 2 Carrier AEW

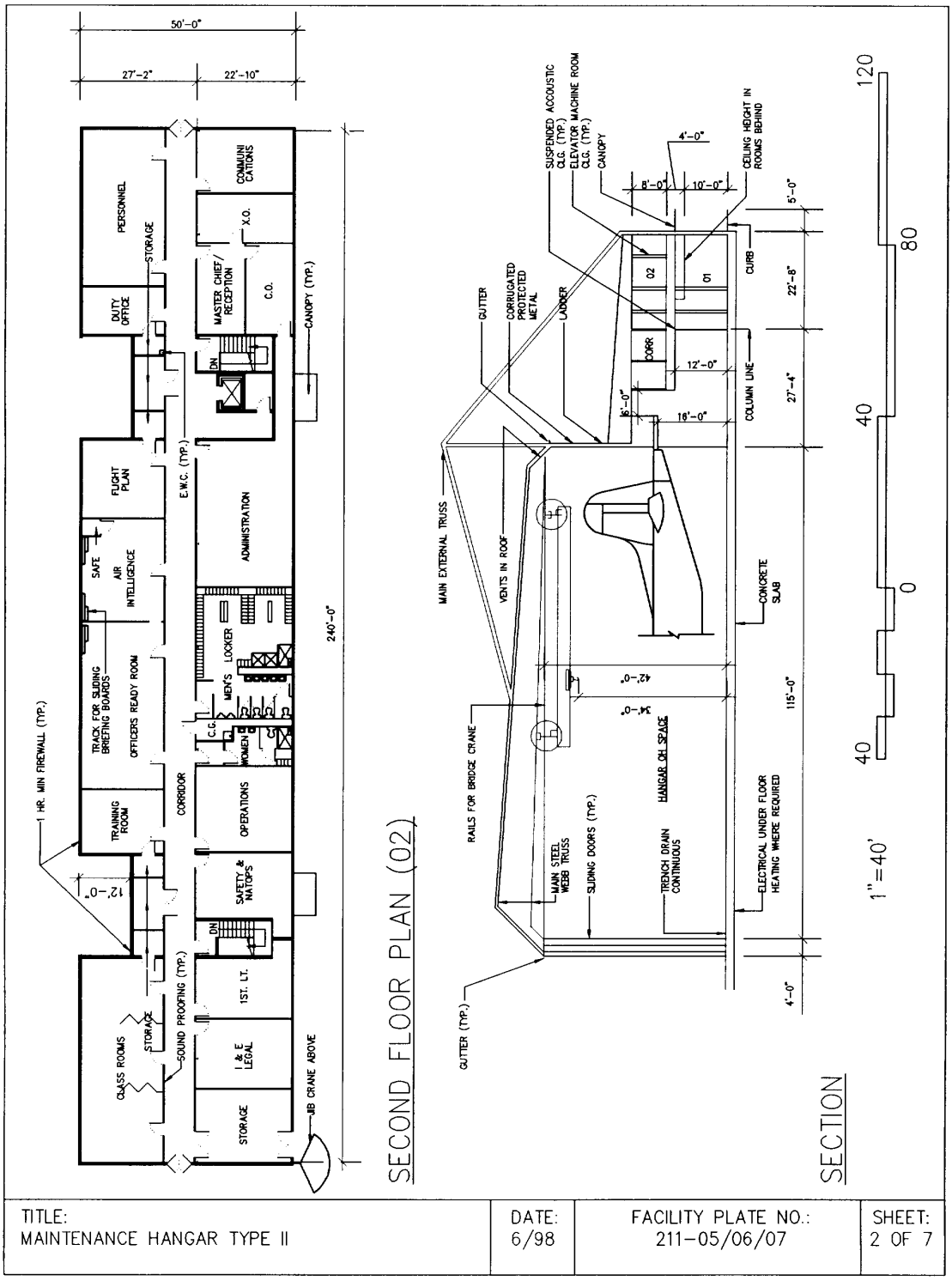
OH SPACE	19,968 S.F.	
01 SPACE – Includes AFFF Mechanical Equipment Room		10,226 S.F.
02 SPACE	8,640 S.F.	
TOTAL	38,834 S.F.	

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
MAINTENANCE HANGAR TYPE 1	12/97	211-05/06/07	8 OF 9

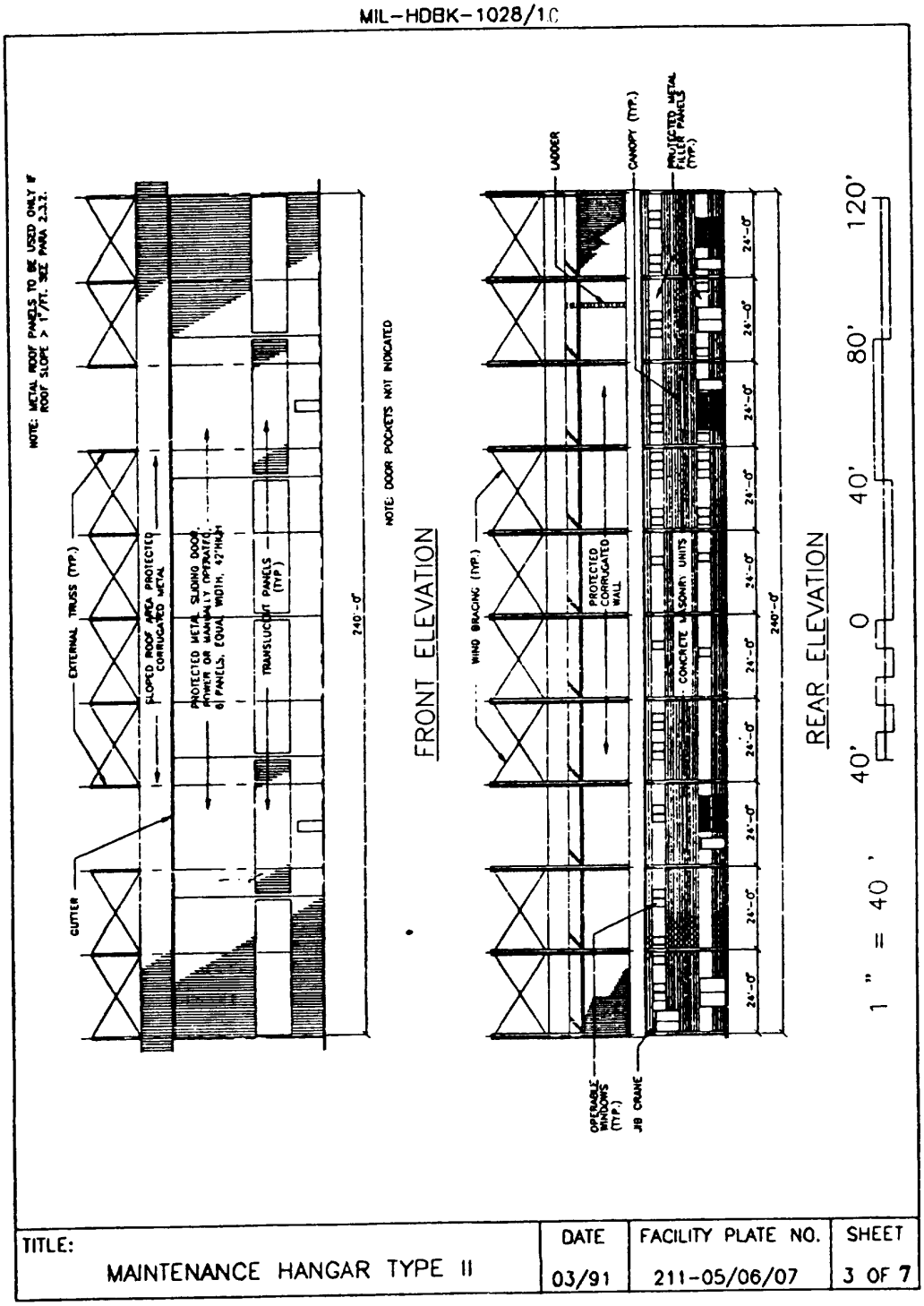
Aircraft type Model	Type Hangar Module	Wingspan Normal (feet)	Wingspan Folded (feet)	Fuselage Length (feet)	Max. height (feet)
A4	I	27'-6"		42"-7"	15'-3"
A6E	I	53'-0"	25'-4"	54'-9"	21'-11"
C2	I	80'-7"	35'-6"	56'-8"	15'-11"
F-14	I	64'-2"	38'-2"	62'-8"	16'-0"
H-1	I	48'-2"		42'-5"	14'-5"
H-2	I	44'-0"		38'-4"	15'-6"
H-3	I	62'-0"		54'-9"	16'-10"
H-46	I	25'-6"		46'-8"	16'-8"
H-60	I	53'-8"		50'-0"	17'-2"
F/A-18(E & F)	I	44'-11"	32'-8"	60'-3"	18'-5"
S-3	I	68'-8"	29'-6"	53'-4"	22'-9"
T-2	I	38'-2		38'-8"	14'-10"
AV-8	I	30'-4"		46'-4"	11'-8"
E-2	I	80'-7"	29'-4"	57'-7"	18'-4"
V-22	I	83'-11"		57'-4"	17'-10.5"

TITLE: MAINTENANCE HANGAR TYPE I	DATE 03/91	FACILITY PLATE NO. 211-05/06/07	SHEET 9 of 9

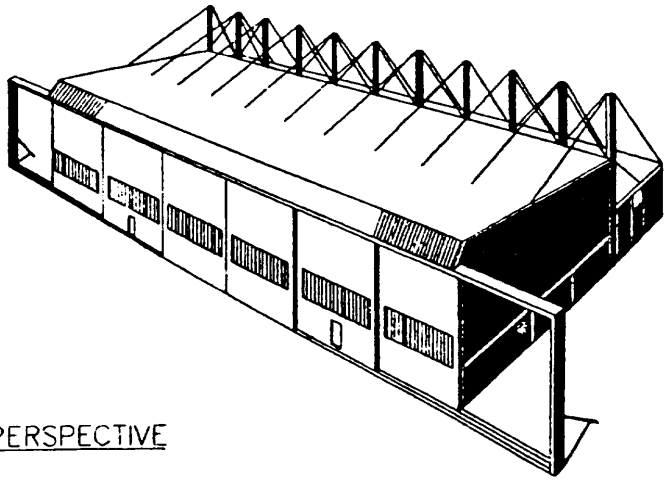

DOOR POCKET FOR END MODULE ONLY
115'-0" OH SPACE
SEE GENERAL NOTE 2.
MEZZANINE ABOVE
PERSONNEL EXIT DOOR IN END WALL ONLY (TYP.)
50'-0"
32'-8"
27'-2"
23'-0"
SEE GENERAL NOTE 3.
AIRFRAMES, TIRES AND WHEELS
AVIATOR'S EQUIPMENT
C.P.O. LOUNGE
E.M. READY ROOM
UP
DUTY OFFICE
MAINT. CONTR.
QUALITY CONTR.
QUALITY CONTR.
MAINT. ADMIN
CONTINUOUS FLOOR DRAIN, SLOPED WITH HANGAR DECK
DRAFT CURTAIN OVER FLOOR DRAIN (TYP.)
10'-0" UTILITY CORRIDOR
EYE EASH AND DELUGE SHOWER
TOOL ROOM
ENC
ELECT. INSTR.
C.G.
MEN
WOMEN
10'-0" UTILITY CORRIDOR
VAULT
ELECTRONICS
LOCKER ROOM
SLIDING DOORS POWER OR MANUALLY OPERATED
PERSONNEL EXIT THROUGH MIDDLE LEAF OF HANGAR DOOR GROUP.
FLOOR DRAIN 1'-0" WIDE
CENTERLINE BETWEEN MODULES FLOOR DRAIN & DRAFT CURTAIN (TYP.)
TYPICAL TRUSS SPACING
ARMAMENT
MECHANICAL EQUIP. ROOM
SEE GENERAL NOTE 1
47'-10"
POWER PLANT
240'-0"
CENTERLINE BRIDGE RAILS
GENERAL NOTES
1. MECHANICAL EQUIPMENT ROOM SHOWN IS CONCEPTUAL. ALTERNATE FLOOR PLAN ARRANGEMENTS ARE ACCEPTABLE PROVIDED GROSS SQUARE FOORAGE IS NOT EXCEEDED, AS SHOWN ON SHEET 8 OF 9.
2. OH DIMENSION IS A STANDARD NON DEVIATIONAL DIMENSION BECUASE IT AFFECTS THOSE FUTURE MISSION CHANGES OF THE HANGER.
3. 8" WALL FOR END MODULE ONLY TO 10' HEIGHT, PROTECTED CORRUGATED METAL ABOVE. PROVIDE FLOOR DRAIN CLEAR OF WALL
120
80
40
0
40
1"=40'
FIRST FLOOR PLAN (01)
TITLE:
MAINTENANCE HANGAR TYPE II
DATE:
6/98
FACILITY PLATE NO.:
211-05/06/07
SHEET:
1 OF7



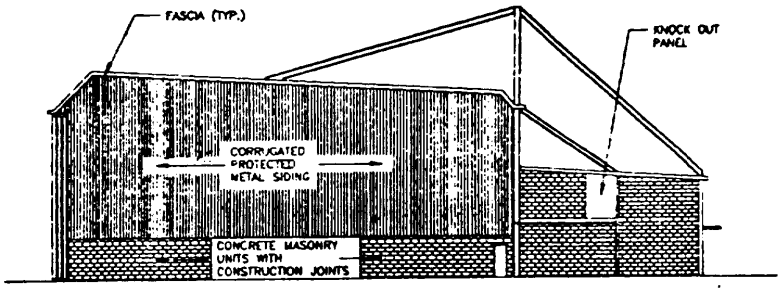
TITLE: MAINTENANCE HANGAR TYPE II	DATE: 6/98	FACILITY PLATE NO.: 211-05/06/07	SHEET: 2 OF 7



TITLE:	DATE	FACILITY PLATE NO.	SHEET
MAINTENANCE HANGAR TYPE II	03/91	211-05/06/07	3 OF 7



PERSPECTIVE

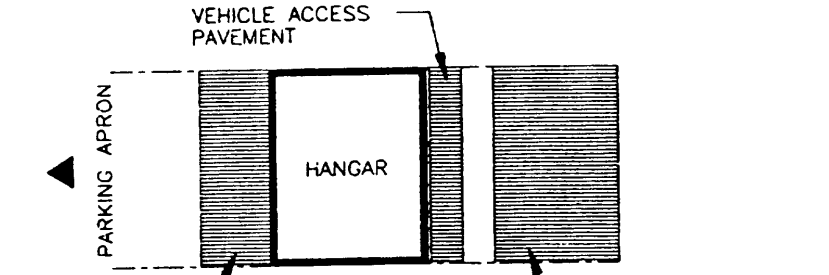


SIDE ELEVATION

1 " = 40 '

40' 0 40' 80' 120'

TITLE: MAINTENANCE HANGAR TYPE II	DATE 03/91	FACILITY PLATE NO. 211-05/06/07	SHEET 4 of 7



TYPICAL SITE PLAN
SCALE : NONE

THE ARRANGEMENT AND FUNCTIONAL LAYOUT INDICATED SHALL BE FOLLOWED UNLESS PRIOR CLEARANCE FOR CHANGE IS OBTAINED FROM THE NAVAL FACILITIES ENGINEERING COMMAND.

THE ARCHITECTURAL TREATMENT, MATERIALS, FRAMING AND CONSTRUCTION MAY VARY.

UTILITIES REQUIREMENTS INDICATED ARE FOR ESTIMATING PURPOSES ONLY.

GENERAL NOTES:

* IF THE NUMBER OF WOMEN TO BE ASSIGNED IS UNKNOWN, PROVIDE AS A MINIMUM THE TOILET FACILITIES INDICATED ON THE DRAWING.
* FOAM CONCENTRATE TANKS PROPORTIONING EQUIPMENT, FIRE PUMPS AND SPRINKLER VALVES SHALL BE LOCATED IN THE MECHANICAL EQUIPMENT ROOM.
* THE DIMENSIONS OF THE OH SPACE SHOULD BE MODIFIED AS APPROPRIATE TO ACCOMMODATE OVER-SIZE AIRCRAFT SUCH AS C-9 AND C-130.

TITLE: MAINTENANCE HANGAR TYPE II	DATE	FACILITY PLATE NO.	SHEET
	03/91	211-05/06/07	5 of 7

PLUMBING REQUIREMENTS

COLD WATER	90 G.P.M.
HOT WATER (01-02 SPACE)	
RECOVERY RATE (100°F RISE)	350 G.P.H.
STORAGE	400 GAL.

FIRE PROTECTION REQUIREMENTS

WATER DEMAND	
FOAM-WATER SPRINKLER SYSTEM	4570 G.P.M.
OSCILLATING NOZZLES	1000 G.P.M.
HOSE STREAMS	500 G.P.M.
TOTAL FIRE PROTECTION DEMAND	6070 G.P.M.

HEATING REQUIREMENTS (MBH)*

INSIDE DESIGN TEMPERATURES		
OH SPACE	60°F	
01-02 SPACE	68°F	
OUTSIDE DESIGN TEMPERATURE	22°F	
HEATING LOAD		
OH SPACE	1450 MBH	
01-02 SPACE	250 MBH	

*BASED ON NORFOLK, VIRGINIA AREA

AIR CONDITIONING REQUIREMENTS*

INSIDE DESIGN TEMPERATURE	76°F D.B.
INSIDE DESIGN HUMIDITY	50%
OUTSIDE DESIGN TEMPERATURE	91°F D.B.
OUTSIDE DESIGN TEMPERATURE	77°F W.B.
COOLING LOAD, 01-02 SPACES	545 MBH

(EXCLUDING MECH RM., PASSAGES, STAIRS, TOILETS, POWER PLANTS, AVIATORS EQ. & AIR FRAMES)

ELECTRICAL REQUIREMENTS (KW)

	OH SPACE	01-02 SPACE
LIGHTS		
CONNECTED LOAD	56	84
ESTIMATED DEMAND	56	84
POWER		
CONNECTED LOAD	837	208
ESTIMATED DEMAND	418	104
TOTAL		
CONNECTED LOAD	893	292
ESTIMATED DEMAND	474	188
ADDITIONAL DEMAND FOR AIR CONDITIONING		63

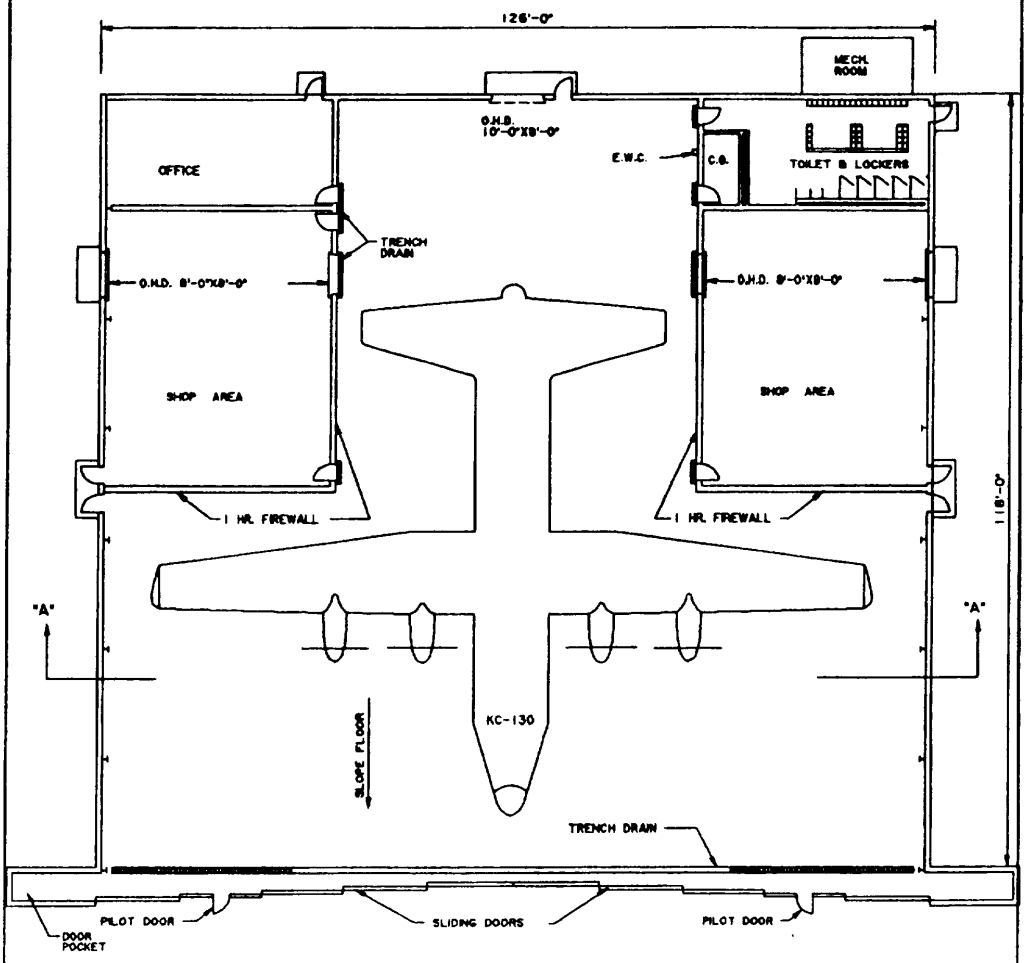
AREAS (SQUARE FEET)

OH SPACE	29,505 S.F.
O1 SPACE – Includes AFFF Mechanical Equipment	12,591 S.F.
02 SPACE	11,440 S.F.
TOTAL	53,536 S.F.

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
MAINTENANCE HANGAR TYPE II	12/97	211-05/06/07	6 OF 7

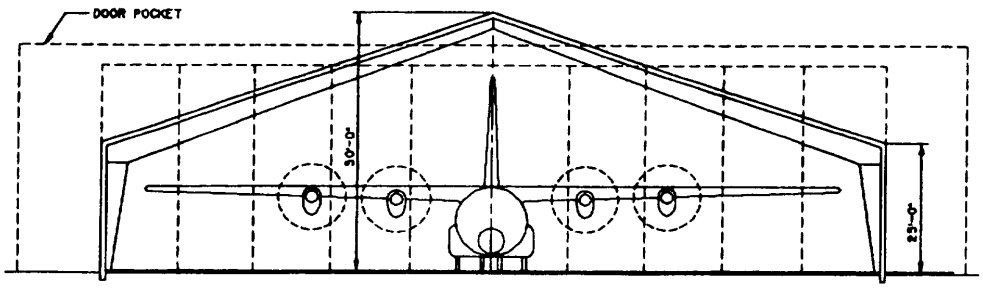
Aircraft type Model	Type Hangar Module	Wingspan Normal (ft-in)	Folded (ft-in)	Fuselage Length (ft-in)	Max height (ft-in)
C-130	II	132'-7"		97'-9"	38'-3"
H53	II	79'0"		73'-4"	29'-5"
P-3	II	99'-8"		116'-10"	15'-11"

TITLE: MAINTENANCE HANGAR TYPE II	DATE 03/91	FACILITY PLATE NO. 211-05/06/07	SHEET 7 of 7



FLOOR PLAN
NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	1 OF 4



SECTION "A"-"A"
NOT TO SCALE

TITLE: PRE-ENGINEERED MAINTENANCE HANGAR	DATE 03/91	FACILITY PLATE NO. 211-04	SHEET 2 OF 4

ARCHITECTURAL REQUIREMENTS

THE DRAWINGS INDICATED IN THIS FACILITY PLATE ARE INTENDED TO PROVIDE GUIDANCE FOR A MINIMUM SUITABLE FACILITY FOR AIRCRAFT MAINTENANCE.

THE ARRANGEMENT AND FUNCTIONAL LAYOUT INDICATED SHALL BE FOLLOWED UNLESS PRIOR CLEARANCE FOR CHANGE IS OBTAINED FROM THE NAVAL FACILITIES ENGINEERING COMMAND. THE ARCHITECTURAL TREATMENT, MATERIALS FRAMING, AND CONSTRUCTION MAY VARY.

DIMENSIONS SHOWN CONFORM TO STOCK DIMENSIONS AND DETAILING OF STANDARD PRE-ENGINEERED STRUCTURES.

DOOR POCKETS AND SLIDING DOORS MAY BE OMITTED IN WARM CLIMATES AT THE OPTION OF THE COMMAND.

WHEN LOCATION REQUIRES, STRUCTURAL DESIGN SHOULD INCORPORATE SUFFICIENT ANCHORAGE AND BRACING FOR EXTREME WIND LOAD.

VERIFY HORIZONTAL AND VERTICAL DIMENSIONS OF ALL AIRCRAFT TO BE ACCOMMODATED. PROVIDE A 3-TON CAPACITY FLOOR SUPPORTED, MOVABLE CRANE.

PROVIDE MOVABLE PARTITION IF REQUIRED TO MEET SPECIAL SPACE LOCATIONS WITHIN SHOP AREA.

UTILITIES REQUIREMENTS INDICATED ARE FOR ESTIMATING PURPOSES ONLY.

PROVIDE MECHANICAL ROOM IF REQUIRED, SIZED TO FIT EQUIPMENT.

FIRE PROTECTION REQUIREMENTS

PROVIDE SEALED HEAD AUTOMATIC SPRINKLERS IN OFFICE, SHOP AREAS, TOILET AND LOCKERS, AND C.G. SPACES.

PROVIDE FOAM-WATER SPRINKLER SYSTEM (0.16 GPM/SQ. FT.) WITH STANDARD SPRINKLERS SUPPLIED THROUGH AUTOMATIC DELUGE VALVES FOR HANGAR AREA. LOCATE DELUGE VALVES IN SHOP AREAS.

PROVIDE 3 AUTOMATIC/MANUALLY ACTIVATED 500 GPM OSCILLATING NOZZLES IN HANGAR. ACTIVATE NOZZLES WITH OVERHEAD DELUGE SYSTEM, OPERATION OF ANY TWO DUAL SPECTRUM (UV/IR) OPTICAL DETECTORS, OR MANUAL RELEASES.

HANGAR WATER FLOW DEMAND 4,000 GPM FOR 45 MIN. + 500 GPM FOR EXTERIOR FIRE HYDRANTS.

PROVIDE TWO 2,500 GAL. AFT STORAGE TANKS AND FOAM EQUIPMENT IN AREA SEPARATED FROM HANGAR BY 1 HOUR CONSTRUCTION.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	3 OF 4

COMMUNICATIONS REQUIREMENTS

PROVIDE TELEPHONE JACKS THOUGHOUT THE STRUCTURE SO THAT IF REQUIRED A VOICE COMMUNICATION SYSTEM CAN BE ESTABLISHED BETWEEN VARIOUS AREAS WITHIN THE HANGAR AND OTHER FACILITIES OF THE ACTIVITY. THE FOLLOWING JACK DISTRIBUTION IS RECOMMENDED:

OFFICE 1
SHOP AREAS 4 12 EQUALLY SPACED ALONG EACH PARTITION DIVIDING SHOP AND HANGAR AREA)
HANGAR AREA 4 12 EQUALLY SPACED ALONG EACH PARTITION DIVIDING SHOP AND HANGAR AREA)

GROSS AREA 21,466 SQ. FT.

PLUMBING REQUIREMENTS

WATER
COLD 65 GPM
DOES NOT INCLUDE FIRE PROTECTION REQUIREMENTS
HOT 35 GPM RECOVERY RATE 100°F RISE
35 GAL. STORAGE

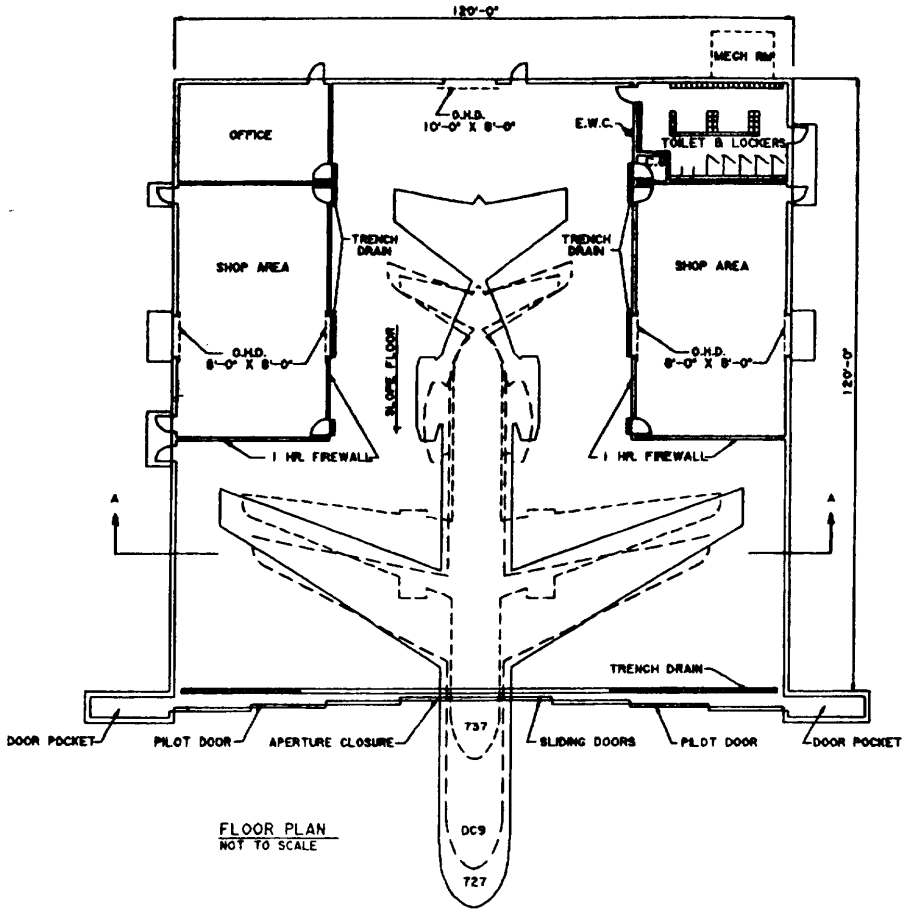
HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE	-50° F	+50° F	+150° F	+250° F
	1834	1572	1310	1048

ELECTRICAL REQUIREMENTS (KW)

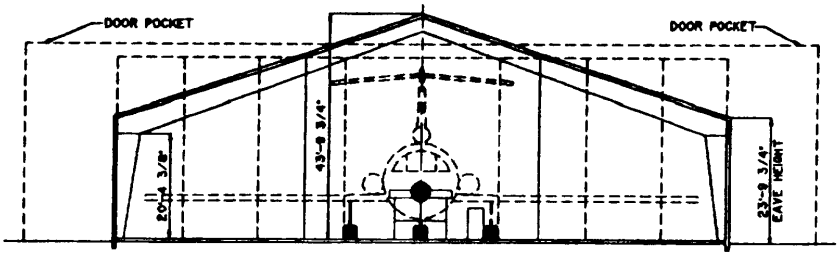
	LIGHTING	POWER	TOTAL
CONNECTED LOAD	65	99	164
ESTIMATED DEMAND	65	79	144

TITLE: PRE-ENGINEERED MAINTENANCE HANGAR	DATE 03/91	FACILITY PLATE NO. 211-04	SHEET 4 OF 4



FLOOR PLAN
NOT TO SCALE

TITLE: PRE-ENGINEERED MAINTENANCE HANGAR	DATE 03/91	FACILITY PLATE NO. 211-04	SHEET 1 OF 4



SECTION A
NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	2 OF 4

ARCHITECTURAL REQUIREMENTS

THE DRAWINGS INDICATED IN THIS FACILITY PLATE ARE INTENDED TO PROVIDE GUIDANCE FOR A MINIMUM SUITABLE FACILITY FOR AIRCRAFT MAINTENANCE.

THE ARRANGEMENT AND FUNCTIONAL LAYOUT INDICATED SHALL BE FOLLOWED UNLESS PRIOR CLEARANCE FOR CHANGE IS OBTAINED FROM THE NAVAL FACILITIES ENGINEERING COMMAND. THE ARCHITECTURAL TREATMENT, MATERIALS FRAMING, AND CONSTRUCTION MAY VARY.

DIMENSIONS SHOWN CONFORM TO STOCK DIMENSIONS AND DETAILING OF STANDARD PRE-ENGINEERED STRUCTURES.

DOOR POCKETS AND SLIDING DOORS MAY BE OMITTED IN WARM CLIMATES AT THE OPTION OF THE COMMAND.

WHEN LOCATION REQUIRES, STRUCTURAL DESIGN SHOULD INCORPORATE SUFFICIENT ANCHORAGE AND BRACING FOR EXTREME WIND LOAD.

VERIFY HORIZONTAL AND VERTICAL DIMENSIONS OF ALL AIRCRAFT TO BE ACCOMMODATED. PROVIDE A 3-TON CAPACITY FLOOR SUPPORTED, MOVABLE CRANE.

PROVIDE MOVABLE PARTITION IF REQUIRED TO MEET SPECIAL SPACE LOCATIONS WITHIN SHOP AREA.

UTILITIES REQUIREMENTS INDICATED ARE FOR ESTIMATING PURPOSES ONLY.

PROVIDE MECHANICAL ROOM IF REQUIRED, SIZED TO FIT EQUIPMENT.

FIRE PROTECTION REQUIREMENTS

PROVIDE SEALED HEAD AUTOMATIC SPRINKLERS IN OFFICE, SHOP AREAS, TOILET AND LOCKERS, AND C.G. SPACES.

PROVIDE FOAM-WATER SPRINKLER SYSTEM (0.16 GPM/SQ. FT.) WITH STANDARD SPRINKLERS SUPPLIED THROUGH AUTOMATIC DELUGE VALVES FOR HANGAR AREA. LOCATE DELUGE VALVES IN SHOP AREAS.

PROVIDE 3 AUTOMATIC/MANUALLY ACTIVATED 500 GPM OSCILLATING NOZZLES IN HANGAR. ACTIVATE NOZZLES WITH OVERHEAD DELUGE SYSTEM, OPERATION OF ANY TWO DUAL SPECTRUM (UV/IR) OPTICAL DETECTORS, OR MANUAL RELEASES.(THROTTLE FOR 0.10 GPM/FT. FLOOR AREA)

HANGAR WATER FLOW DEMAND 2,500 GPM FOR 45 MIN. + 500 GPM FOR EXTERIOR FIRE HYDRANTS.

PROVIDE TWO 1,600 GAL. AFT STORAGE TANKS AND FOAM EQUIPMENT IN AREA SEPARATED FROM HANGAR BY 1 HOUR CONSTRUCTION.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	3 OF 4

COMMUNICATIONS REQUIREMENTS

PROVIDE TELEPHONE JACKS THOUGHOUT THE STRUCTURE SO THAT IF REQUIRED, A VOICE COMMUNICATION SYSTEM CAN BE ESTABLISHED BETWEEN VARIOUS AREAS WITHIN THE HANGAR AND OTHER FACILITIES OF THE ACTIVITY. THE FOLLOWING JACK DISTRIBUTION IS RECOMMENDED:

OFFICE	1	
SHOP AREAS	4	(2 EQUALLY SPACED ALONG EACH PARTITION DIVIDING SHOP AND HANGAR AREA)
HANGAR AREA	4	(2 EQUALLY SPACED ALONG EACH PARTITION DIVIDING SHOP AND HANGAR AREA)

GROSS AREA 14,700 SQ. FT.

PLUMBING REQUIREMENTS

WATER

COLD 65 GPM
DOES NOT INCLUDE FIRE PROTECTION REQUIREMENTS
HOT 35 GPM RECOVERY RATE (100°F RISE)
35 GAL. STORAGE

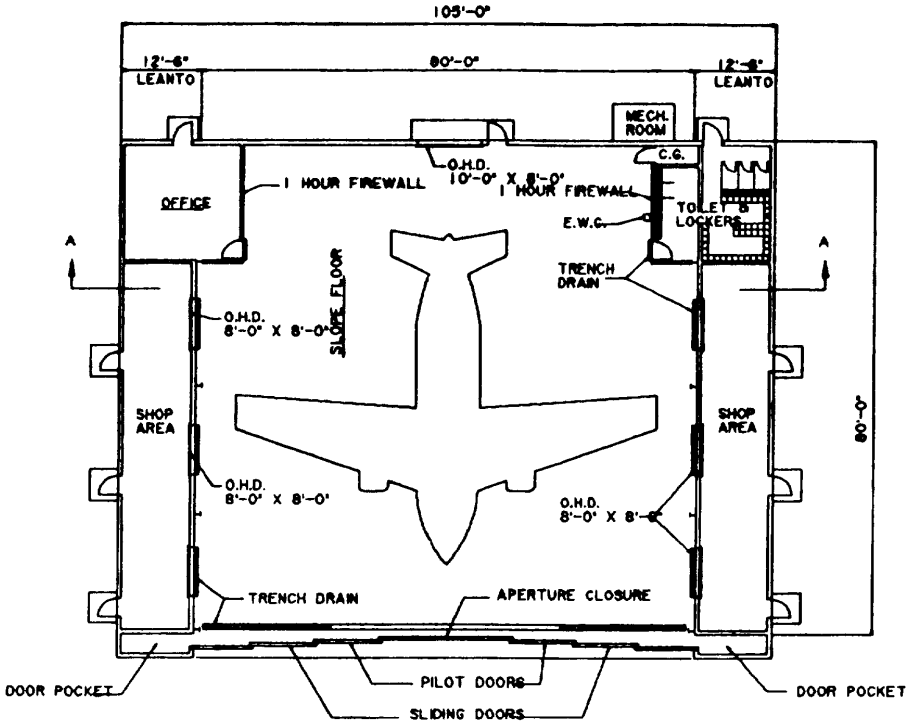
HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE	-50°F	+50°F	+150°F	+250°F
	1,335	1,145	958	763

ELECTRICAL REQUIREMENTS (KW)

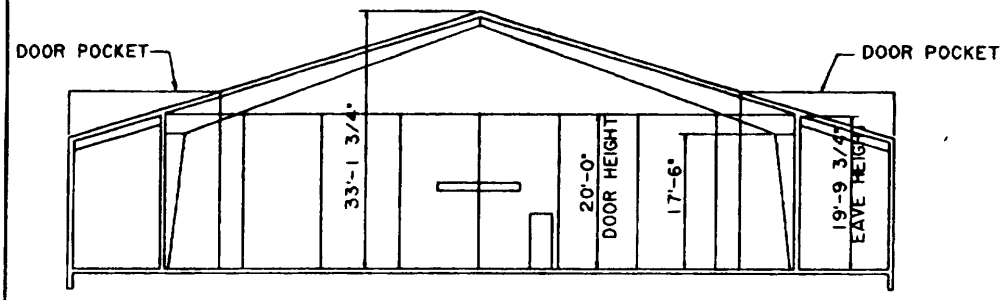
	LIGHTING	POWER	TOTAL
CONNECTED LOAD	72	100.8	172.8
ESTIMATED DEMAND	68.4	90.72	159.12

TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	4 OF 4



FLOOR PLAN
NOT TO SCALE

TITLE: PRE-ENGINEERED MAINTENANCE HANGAR	DATE 03/91	FACILITY PLATE NO. 211-04	SHEET 1 OF 4



SECTION A
NOT TO SCALE

TITLE: PRE-ENGINEERED MAINTENANCE HANGAR	DATE 03/91	FACILITY PLATE NO. 211-04	SHEET 2 OF 4

ARCHITECTURAL REQUIREMENTS

THE DRAWINGS INDICATED IN THIS FACILITY PLATE ARE INTENDED TO PROVIDE GUIDANCE FOR A MINIMUM SUITABLE FACILITY FOR AIRCRAFT MAINTENANCE.

THE ARRANGEMENT AND FUNCTIONAL LAYOUT INDICATED SHALL BE FOLLOWED UNLESS PRIOR CLEARANCE FOR CHANGE IS OBTAINED FROM THE NAVAL FACILITIES ENGINEERING COMMAND. THE ARCHITECTURAL TREATMENT, MATERIALS FRAMING, AND CONSTRUCTION MAY VARY.

DIMENSIONS SHOWN CONFORM TO STOCK DIMENSIONS AND DETAILING OF STANDARD PRE-ENGINEERED STRUCTURES.

DOOR POCKETS AND SLIDING DOORS MAY BE OMITTED IN WARM CLIMATES AT THE OPTION OF THE COMMAND.

WHEN LOCATION REQUIRES, STRUCTURAL DESIGN SHOULD INCORPORATE SUFFICIENT ANCHORAGE AND BRACING FOR EXTREME WIND LOAD.

VERIFY HORIZONTAL AND VERTICAL DIMENSIONS OF ALL AIRCRAFT TO BE ACCOMMODATED. PROVIDE A 3-TON CAPACITY FLOOR SUPPORTED, MOVABLE CRANE.

PROVIDE MOVABLE PARTITION IF REQUIRED TO MEET SPECIAL SPACE LOCATIONS WITHIN SHOP AREA.

UTILITIES REQUIREMENTS INDICATED ARE FOR ESTIMATING PURPOSES ONLY.

PROVIDE MECHANICAL ROOM IF REQUIRED, SIZED TO FIT EQUIPMENT.

FIRE PROTECTION REQUIREMENTS

PROVIDE SEALED HEAD AUTOMATIC SPRINKLERS IN OFFICE, SHOP AREAS, TOILET AND LOCKERS, AND C.G. SPACES.

PROVIDE FOAM-WATER SPRINKLER SYSTEM (0.16 GPM/SQ. FT.) WITH STANDARD SPRINKLERS SUPPLIED THROUGH AUTOMATIC DELUGE VALVES FOR HANGAR AREA. LOCATE DELUGE VALVES IN SHOP AREAS.

PROVIDE 2 AUTOMATIC/MANUALLY ACTIVATED 500 GPM OSCILLATING NOZZLES IN HANGAR. ACTIVATE NOZZLES WITH OVERHEAD DELUGE SYSTEM, OPERATION OF ANY TWO DUAL SPECTRUM (THROTTLE FOR 0.10 GPM/FT. FLOOR AREA)

HANGAR WATER FLOW DEMAND 15,000 GPM FOR 45 MIN. + 500 GPM FOR EXTERIOR FIRE HYDRANTS.

PROVIDE TWO 1,000 GAL. AFT STORAGE TANKS AND FOAM EQUIPMENT IN AREA SEPARATED FROM HANGAR BY 1 HOUR CONSTRUCTION.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	3 OF 4

COMMUNICATIONS REQUIREMENTS

PROVIDE TELEPHONE JACKS THOUGHOUT THE STRUCTURE SO THAT IF REQUIRED, A VOICE COMMUNICATION SYSTEM CAN BE ESTABLISHED BETWEEN VARIOUS AREAS WITHIN THE HANGAR AND OTHER FACILITIES OF THE ACTIVITY. THE FOLLOWING JACK DISTRIBUTION IS RECOMMENDED:

OFFICE	1	
SHOP AREAS	4	(2 EQUALLY SPACED ALONG EACH PARTITION DIVIDING SHOP AND HANGAR AREA)
HANGAR AREA	4	(2 EQUALLY SPACED ALONG EACH PARTITION DIVIDING SHOP AND HANGAR AREA)

GROSS AREA 8,800 SQ. FT.

PLUMBING REQUIREMENTS

WATER

COLD 65 GPM
DOES NOT INCLUDE FIRE PROTECTION REQUIREMENTS

HOT 35 GPM RECOVERY RATE (100°F RISE)
35 GAL. STORAGE

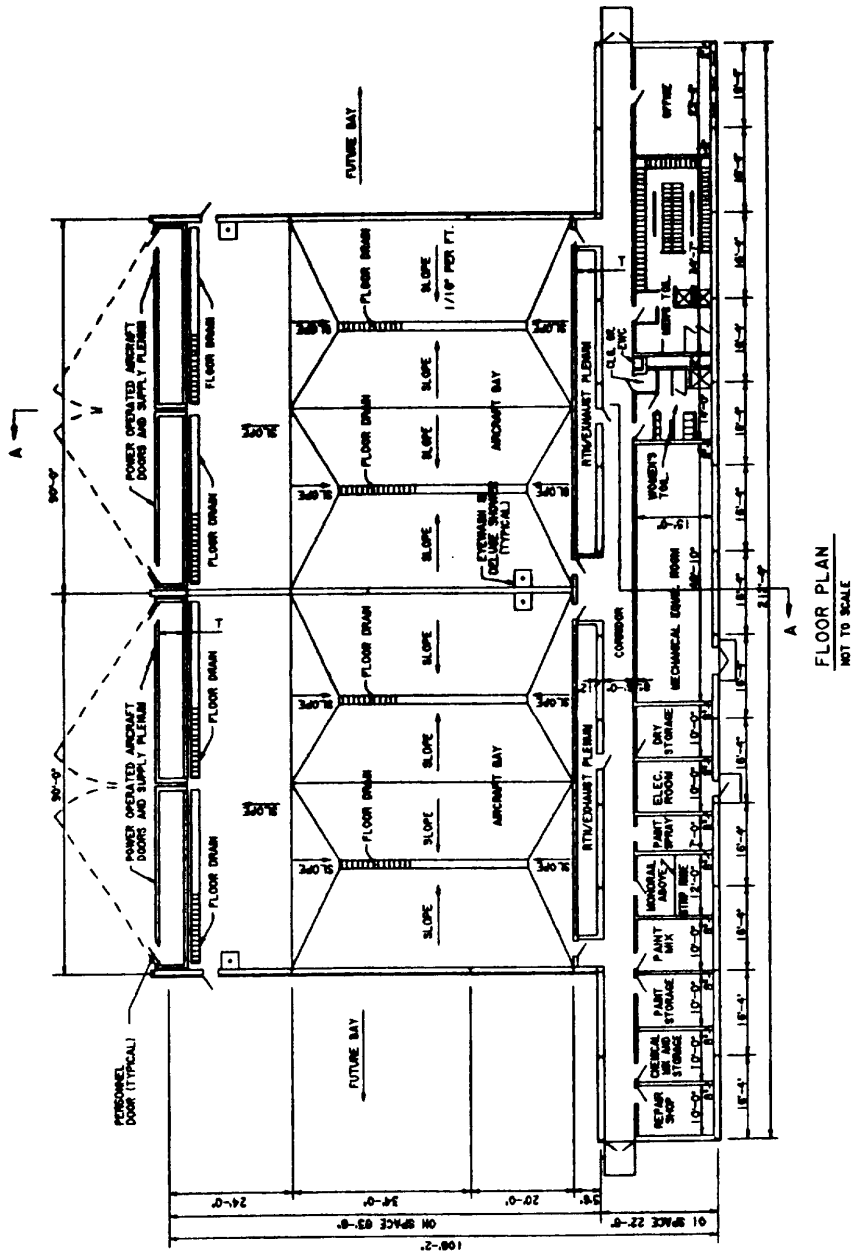
HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE	-50° F	+50° F	+150° F	+250° F
	826	708	590	472

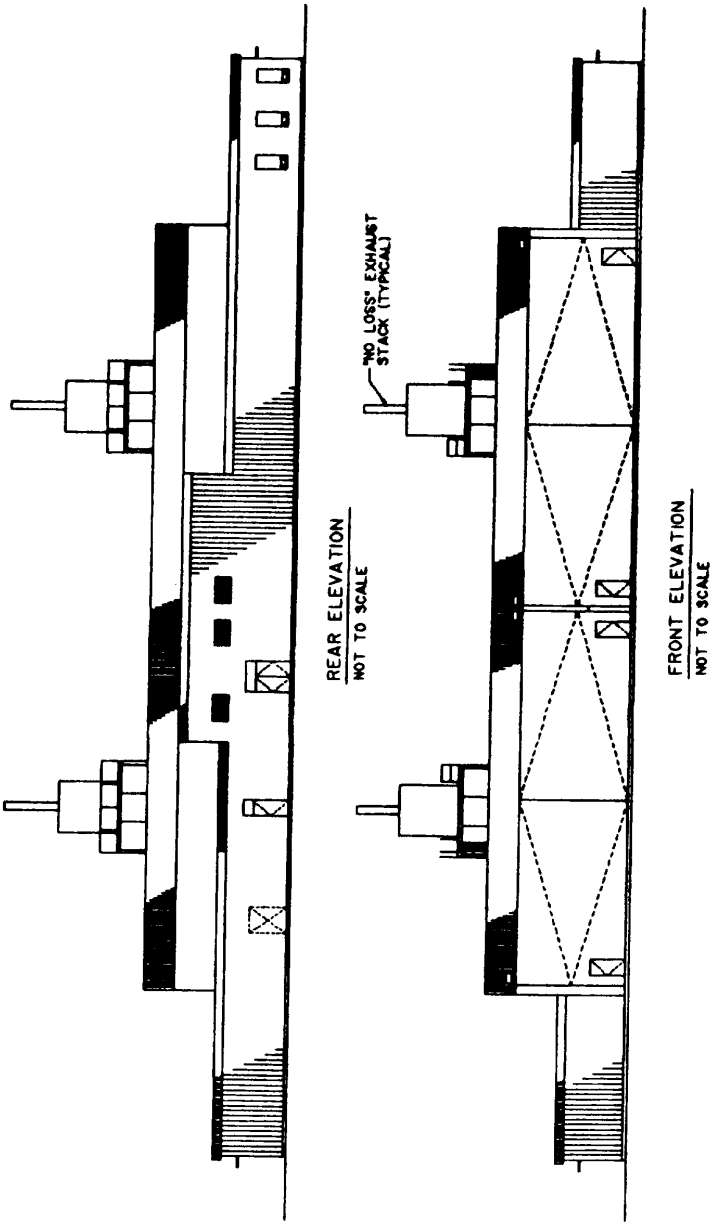
ELECTRICAL REQUIREMENTS (KW)

	LIGHTING	POWER	TOTAL
CONNECTED LOAD	44	62	106
ESTIMATED DEMAND	41.8	55.8	97.5

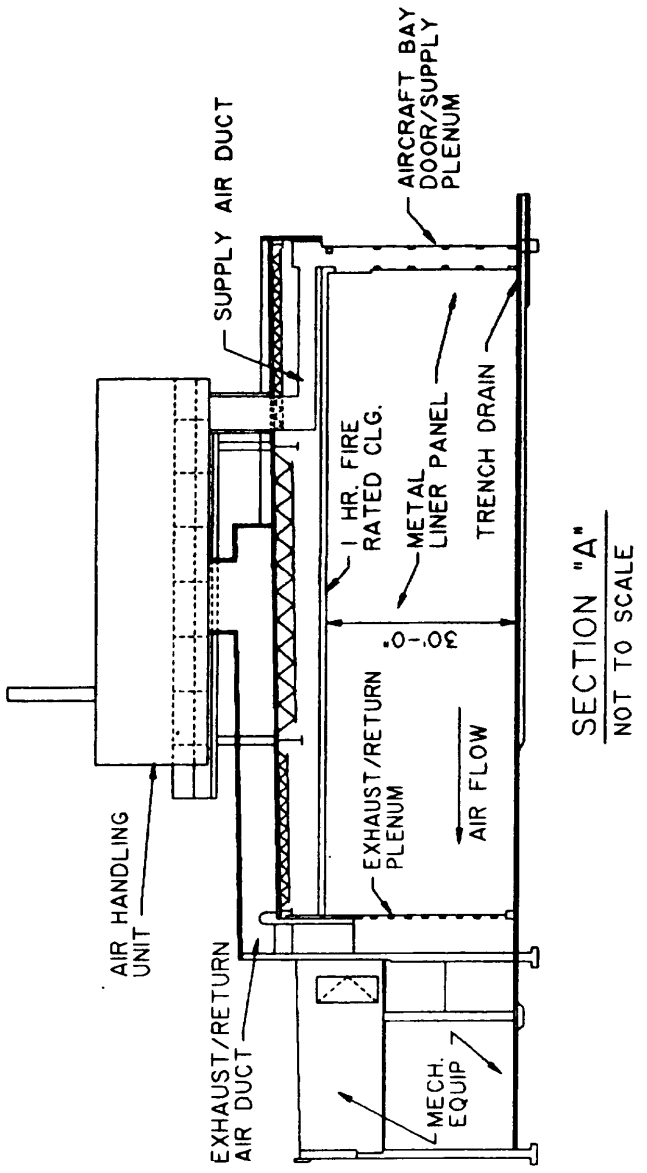
TITLE:	DATE	FACILITY PLATE NO.	SHEET
PRE-ENGINEERED MAINTENANCE HANGAR	03/91	211-04	4 OF 4



TITLE: CORROSION CONTROL HANGAR TYPE "A" SMALL	DATE 03/91	FACILITY PLATE NO. 211-03	SHEET 1 OF 4



TITLE: CORROSION CONTROL HANGAR TYPE "A" SMALL	DATE 03/91	FACILITY PLATE NO. 211-03	SHEET 2 OF 4



SECTION "A"
NOT TO SCALE

TITLE: CORROSION CONTROL HANGAR TYPE "A" SMALL	DATE 03/91	FACILITY PLATE NO. 211-03	SHEET 3 OF 4

NOTES

PLUMBING REQUIREMENTS

COLD WATER	65 G.P.M.
HOT WATER (01 SPACE)	40 G.P.H.
RECOVERY RATE (THRU 100° F RISE)	
STORAGE	40 GAL.

FIRE PROTECTION REQUIREMENTS

SPRINKLERS (FOAM-WATER)	1123 G.P.M.
OSCILLATING NOZZLES	702 G.P.M.
HOSE STREAMS	500 G.P.M.
TOTAL (EACH BAY)	2325 G.P.M.

HEATING REQUIREMENTS*

INSIDE DESIGN TEMPERATURE	
OH SPACE	85°F
01 SPACE	68°F
OUTSIDE DESIGN TEMPERATURE	22 °F
HEATING LOAD	
OH SPACE	36,740,000 BTU/HR (W/O HEAT RECOVERY)
01 SPACE	167,000 BTU/HR

AIR CONDITIONING REQUIREMENTS*

INSIDE DESIGN TEMPERATURE	76° F.D.B.
INSIDE DESIGN HUMIDITY	50%
OUTSIDE DESIGN TEMPERATURE	91° F.D.B.
	76° F.W.B.
COOLING LOAD, OFFICE	12,000 BTU/HR

ELECTRICAL REQUIREMENTS (KW)

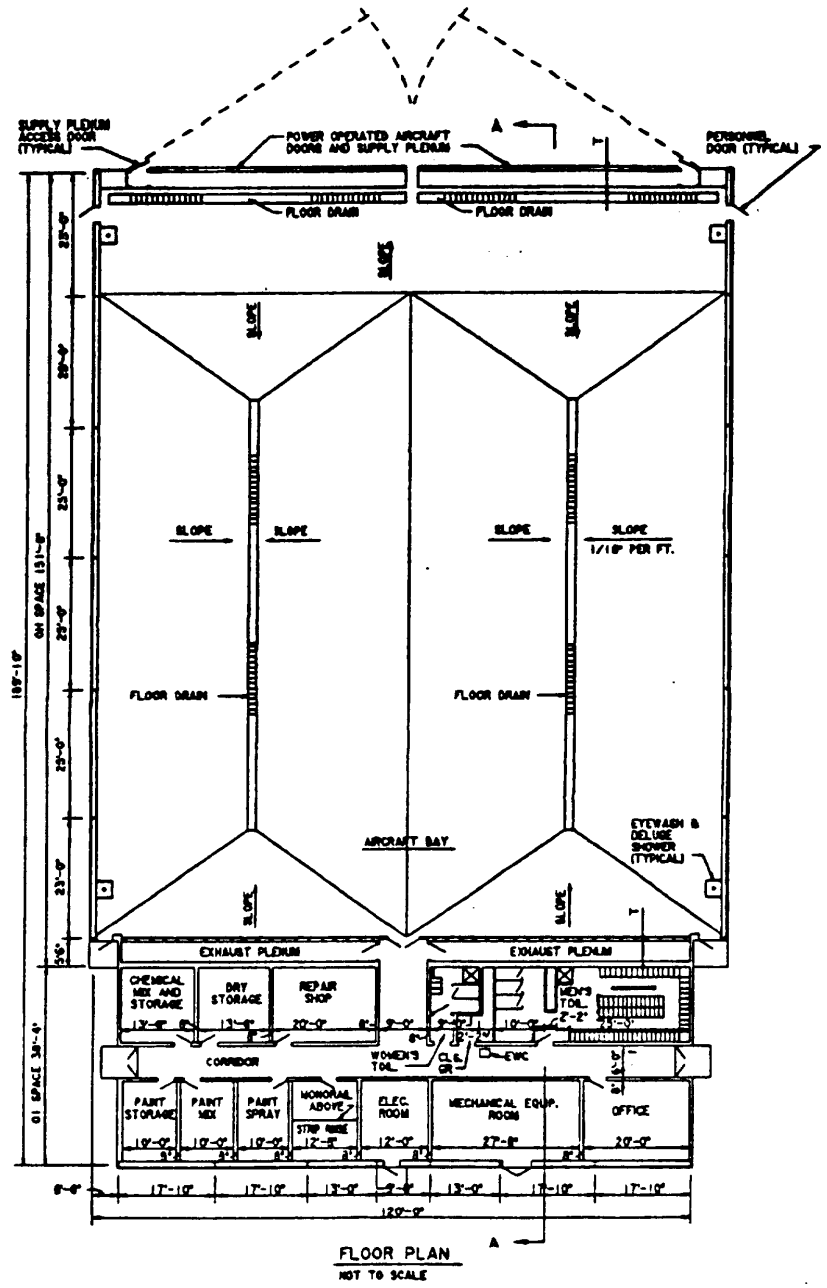
	MODULE OH SPACE	01 SPACE
LIGHTS		
CONNECTED LOAD	40	4
POWER		
CONNECTED LOAD	1289	4
TOTAL		
CONNECTED LOAD	1329	8
ESTIMATED DEMAND	1273	4
ADDITIONAL DEMAND FOR AIR CONDITIONING, OFFICE		2

BAY DIMENSIONS

BAY DIMENSIONS SHOWN WILL SUPPORT S-3 AIRCRAFT, AND PROVIDE 10 FOOT HORIZONTAL AND 6 FOOT VERTICAL CLEARANCE BETWEEN AIRCRAFT AND HANGAR BAY WALLS/DOORS/CEILINGS. REDUCED CLEARANCES SHALL NOT BE USED WITHOUT PRIOR NAVFAC APPROVAL.

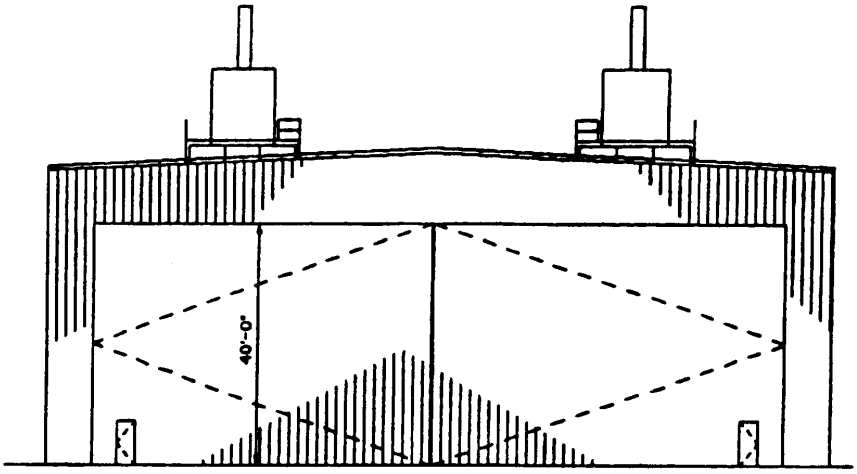
* REQUIREMENTS BASED ON NORFOLK, VIRGINIA AREA. PROVIDE COOLING FOR OFFICE SPACE ONLY. OH SPACE HEATING REQUIREMENTS VARY. VERIFY SPECIFIC FACILITY REQUIREMENTS.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
CORROSION CONTROL HANGAR TYPE "A" SMALL	03/91	211-03	4 OF 4

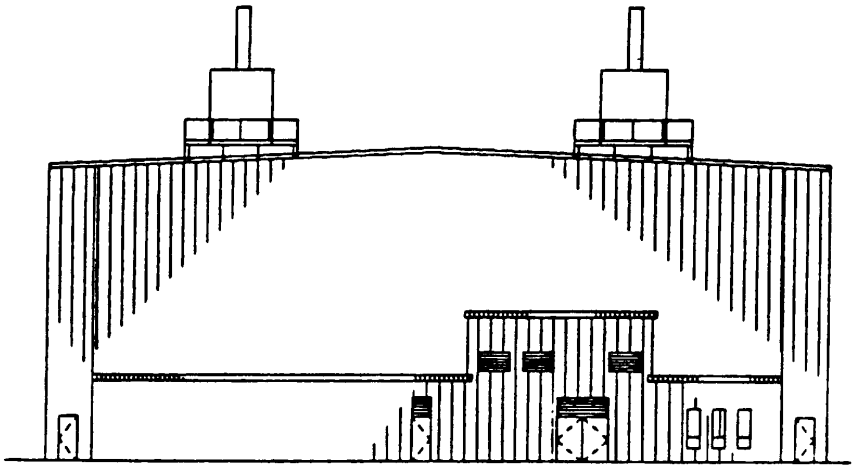


FLOOR PLAN
NOT TO SCALE

TITLE:	CORROSION CONTROL HANGAR TYPE "B" LARGE	DATE 03/91	FACILITY PLATE NO. 211-03	SHEET 1 OF 5

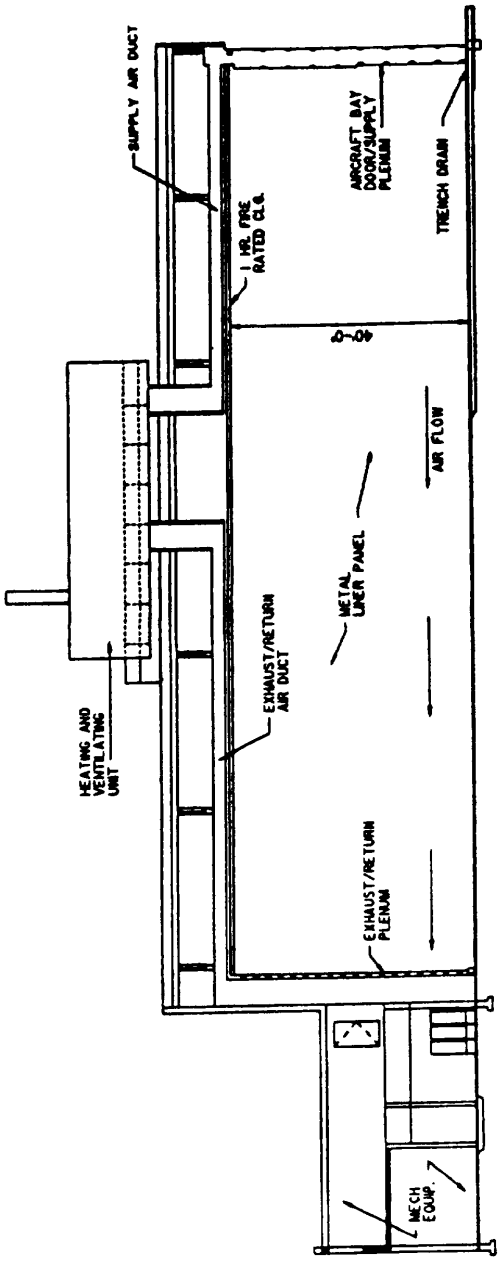


FRONT ELEVATION
NOT TO SCALE



REAR ELEVATION
NOT TO SCALE

TITLE: CORROSION CONTROL HANGAR TYPE "B" LARGE	DATE 03/91	FACILITY PLATE NO. 211-03	SHEET 2 OF 5



SECTION "A"
NOT TO SCALE

TITLE: CORROSION CONTROL HANGAR TYPE "B" LARGE	DATE 03/91	FACILITY PLATE NO. 211-03	SHEET 3 OF 5

NOTES

PLUMBING REQUIREMENTS

COLD WATER	80 G.P.M.
HOT WATER (01 SPACE) RECOVERY RATE (THRU 100° F RISE)	55 G.P.H.
STORAGE	55 GAL.

FIRE PROTECTION REQUIREMENTS

SPRINKLERS (FOAM-WATER)	2803 G.P.M.
OSCILLATING NOZZLES	1752 G.P.M.
HOSE STREAMS	500 G.P.M.
TOTAL (EACH BAY)	4555 G.P.M.

HEATING REQUIREMENTS*

INSIDE DESIGN TEMPERATURE
- OH SPACE 85°F
- 01 SPACE 68°F

OUTSIDE DESIGN TEMPERATURE 22°F

HEATING LOAD
- OH SPACE 32.660.000 BTU/HR (W/O HEAT RECOVERY)
- 01 SPACE 150.000 BTU/HR

AIR CONDITIONING REQUIREMENTS*

INSIDE DESIGN TEMPERATURE	76° F.D.B.
INSIDE DESIGN HUMIDITY	50%
OUTSIDE DESIGN TEMPERATURE	91° F.D.B. 76° F.W.B.
COOLING LOAD, OFFICE	12.000 BTU/HR

ELECTRICAL REQUIREMENTS (KW)

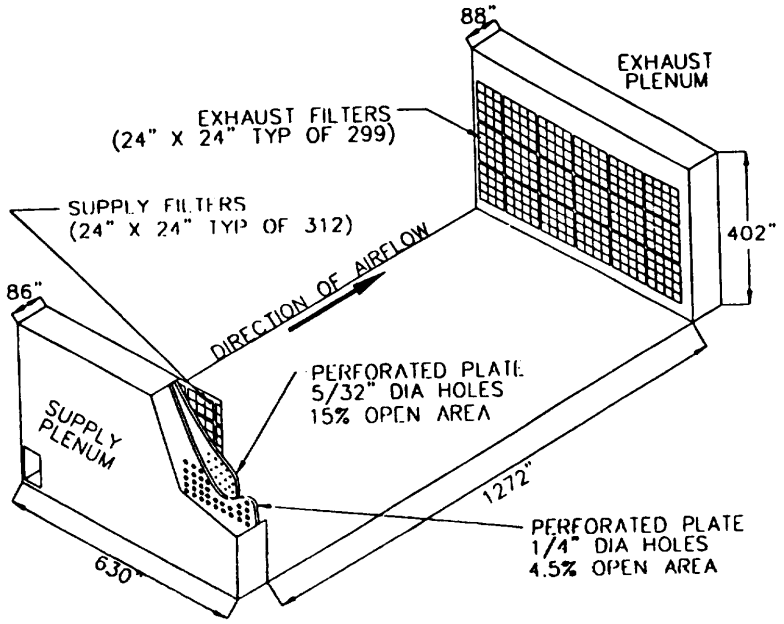
	MODULE OH SPACE	MODULE 01 SPACE
LIGHTS		
CONNECTED LOAD	55	4
POWER		
CONNECTED LOAD	898	4
TOTAL		
CONNECTED LOAD	953	8
ESTIMATED DEMAND	877	4
ADDITIONAL DEMAND FOR AIR CONDITIONING OFFICE		2

BAY DIMENSIONS

BAY DIMENSIONS SHOWN WILL SUPPORT P-3 AIRCRAFT, AND PROVIDE 10 FOOT HORIZONTAL AND 6 FOOT VERTICAL CLEARANCE BETWEEN AIRCRAFT AND HANGAR BAY WALLS/DOORS/ CEILINGS. REDUCED CLEARANCES SHALL NOT BE USED WITHOUT PRIOR NAVFAC APPROVAL.

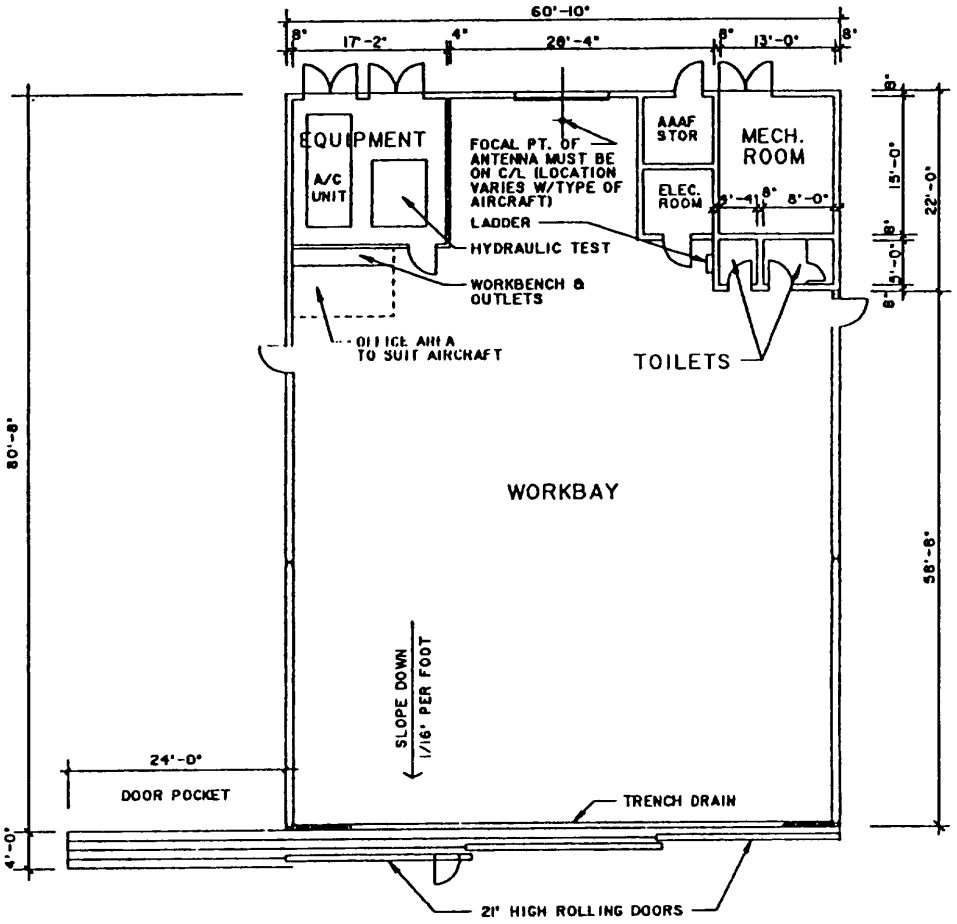
* REQUIREMENTS BASED ON NORFOLK, VIRGINIA AREA. PROVIDE COOLING FOR OFFICE SPACE ONLY. OH SPACE BAY HEATING REQUIREMENTS VARY. VERIFY SPECIFIC FACILITY REQUIREMENTS.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
CORROSION CONTROL HANGAR TYPE "B" LARGE	03/91	211-03	4 OF 5



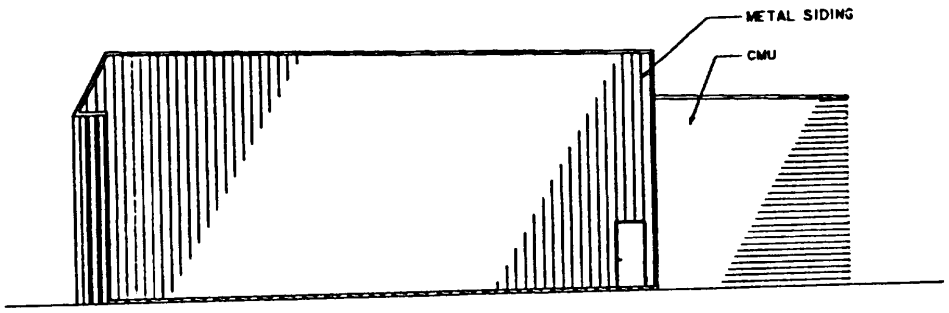
PARTIAL HANGAR BAY ISOMETRIC VIEW
WITH EXAMPLE SUPPLY PLENUM DETAILS

TITLE: CORROSION CONTROL HANGAR TYPE "B" LARGE	DATE 01/97	FACILITY PLATE NO. 211-03	SHEET 5 OF 5

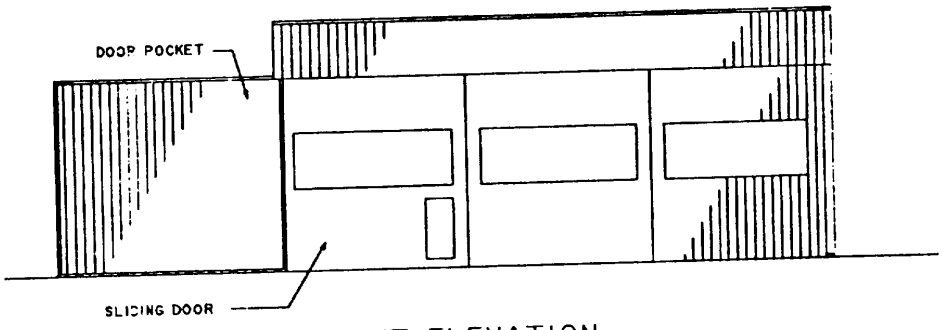


FLOOR PLAN
NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 1 OF 5

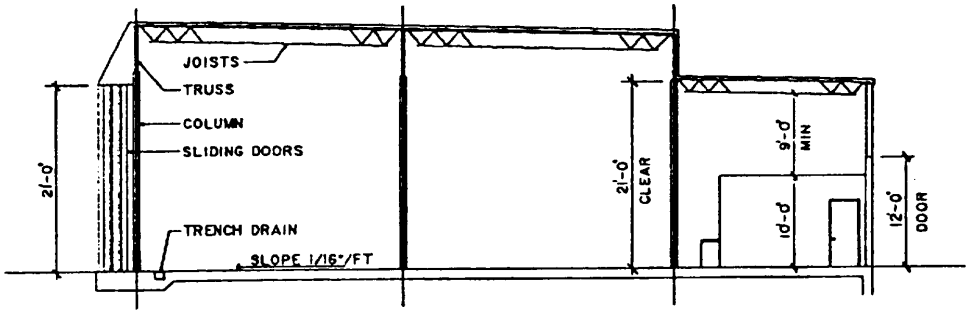


SIDE ELEVATION
NOT TO SCALE



FRONT ELEVATION
NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 2 OF 5



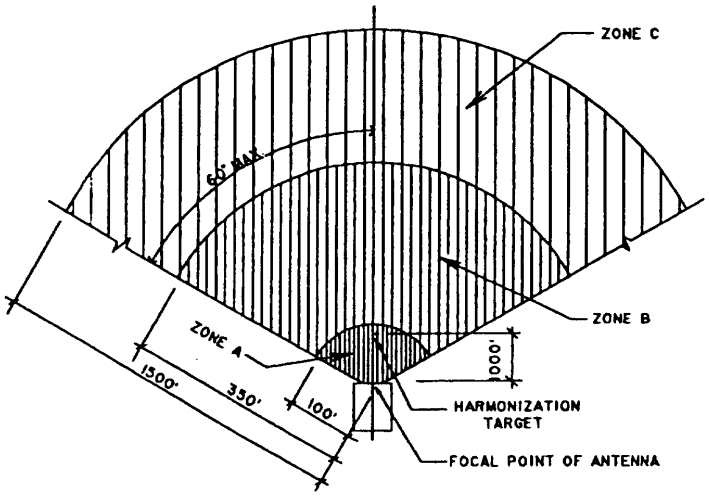
BUILDING SECTION
NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 3 OF 5

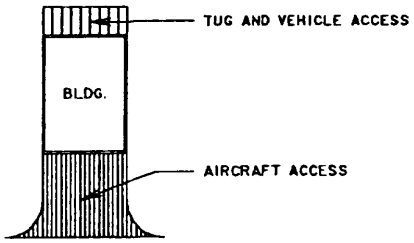
ZONE A: KEEP CLEAR OF PERSONNEL, MISSILES, FUSES, ETC., BUILDINGS MOTOR VEHICLES, AIRCRAFT & OTHER RADAR REFLECTIVE OBJECTS AND DISASSEMBLED ELECTRO-EXPLOSIVE DEVICES.

ZONE B: KEEP CLEAR OF MISSILES, FUSES, ETC., BUILDINGS, MOTOR VEHICLES, AIRCRAFT & OTHER RADAR REFLECTIVE OBJECTS AND DISASSEMBLED ELECTRO-EXPLOSIVE DEVICES.

ZONE C: KEEP CLEAR OF DISASSEMBLED ELECTRO-EXPLOSIVE DEVICES.



PLOT PLAN
NOT TO SCALE



TYPICAL SITE PLAN
NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 4 OF 5

NOTES

PLUMBING REQUIREMENTS

COLD WATER	45 GPM
HOT WATER	
RECOVERY RATE (100°RISE)	18 GPH
STORAGE	18 GAL

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (MBTU/HR)

OUTSIDE DESIGN TEMPERATURE

-5 F°	+5 F°	+15 F°	+25 F°
160	137	114	91

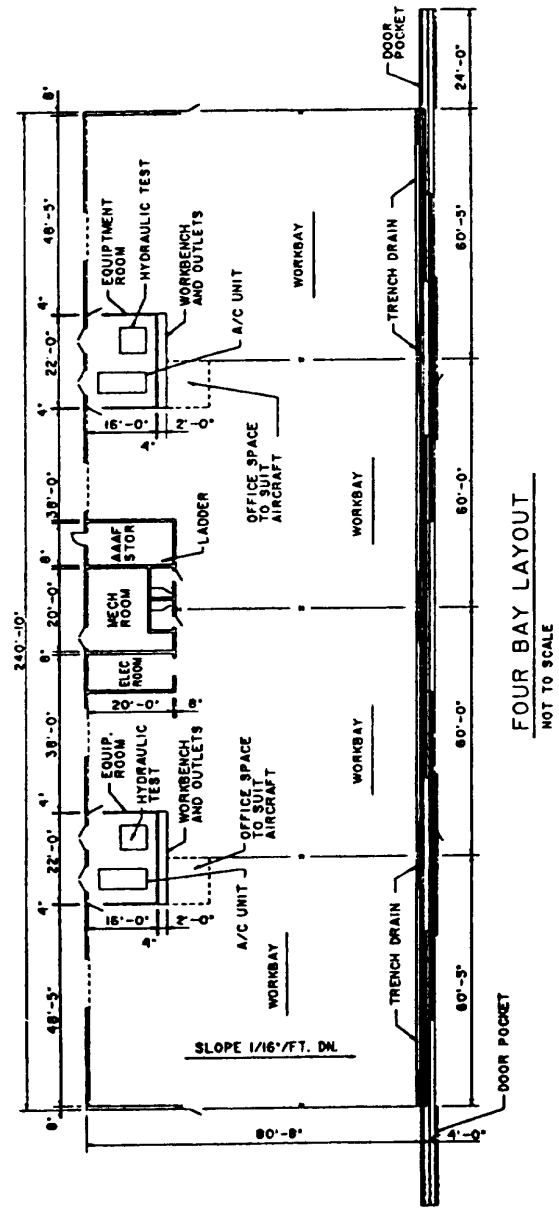
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	18.4
ESTIMATED DEMAND	14.2
POWER	
CONNECTED LOAD	120.0
ESTIMATED DEMAND	96.0
TOTAL	
CONNECTED LOAD	138.4
ESTIMATED DEMAND	110.2

AREAS

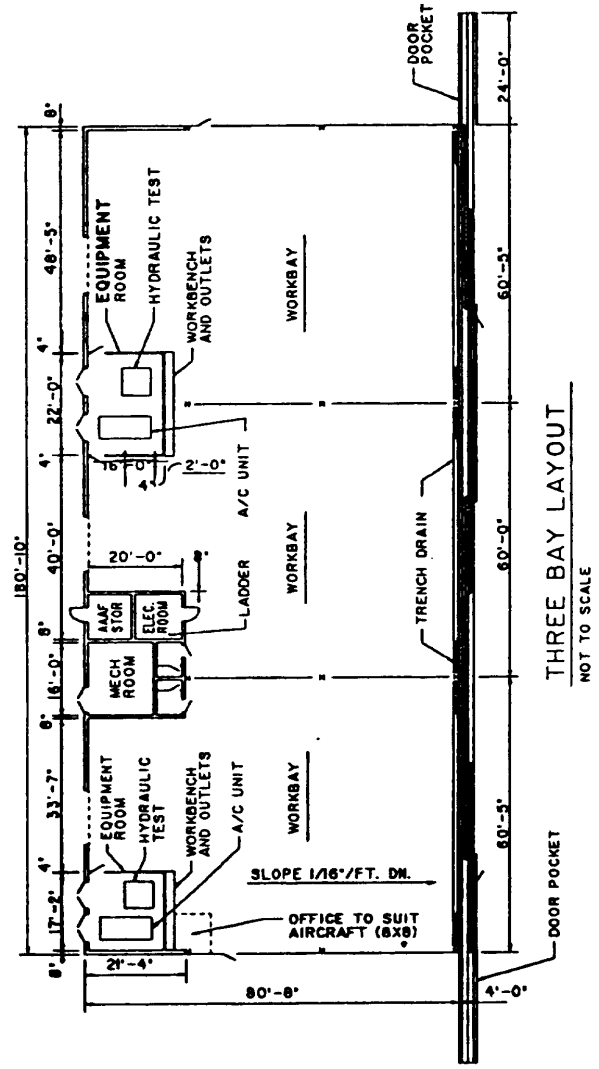
GROSS AREA INCLUDING MECHANICAL ROOM AND EQUIPMENT ROOM	5,246 SF

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AIRCRAFT WEAPONS ALIGNMENT FACILITY	03/91	211-82	5 OF 5

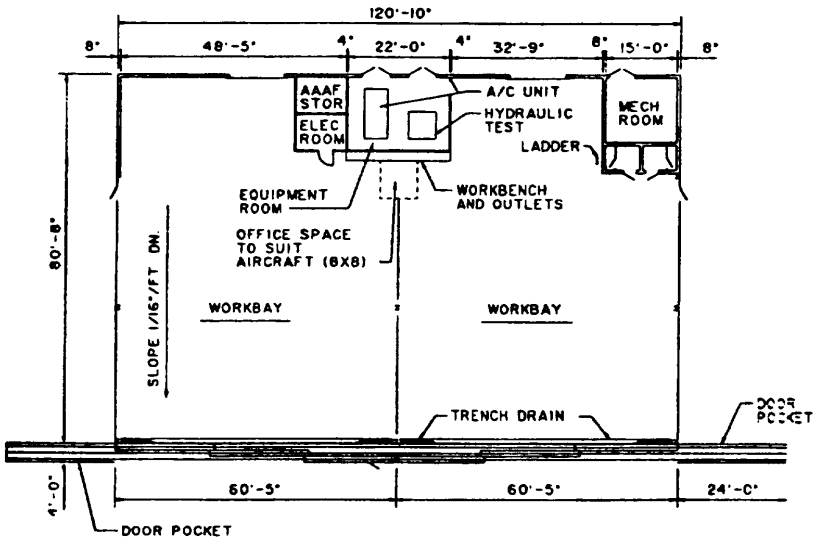


FOUR BAY LAYOUT
NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 1 OF 6



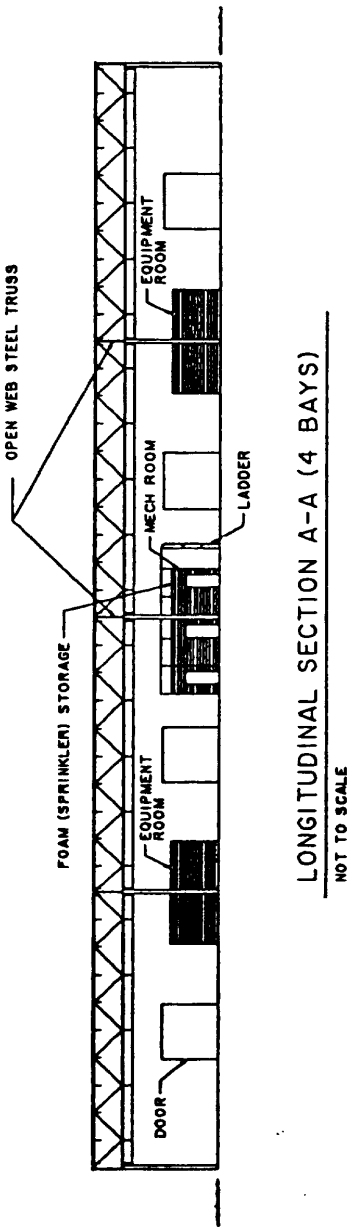
TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 2 OF 6



TWO BAY LAYOUT

NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 3 OF 6



LONGITUDINAL SECTION A-A (4 BAYS)

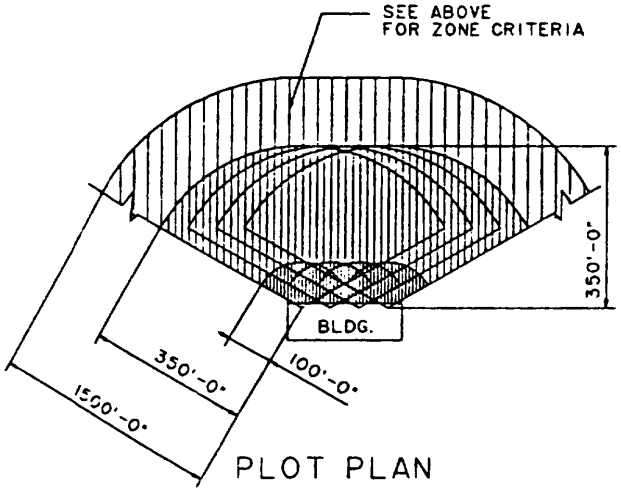
NOT TO SCALE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 4 OF 6

ZONE A: KEEP CLEAR OF PERSONNEL, MISSILES, FUSES, ETC., BUILDINGS MOTOR VEHICLES, AIRCRAFT & OTHER RADAR REFLECTIVE OBJECTS AND DISASSEMBLED ELECTRO-EXPLOSIVE DEVICES.

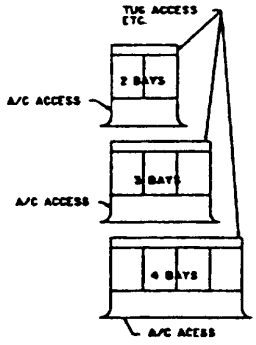
ZONE B: KEEP CLEAR OF MISSILES, FUSES, ETC., BUILDINGS, MOTOR VEHICLES, AIRCRAFT & OTHER RADAR REFLECTIVE OBJECTS AND DISASSEMBLED ELECTRO-EXPLOSIVE DEVICES.

ZONE C: KEEP CLEAR OF DISASSEMBLED ELECTRO-EXPLOSIVE DEVICES.



PLOT PLAN

NOT TO SCALE



TYPICAL
SITE PLANS

SCALE NONE

TITLE: AIRCRAFT WEAPONS ALIGNMENT FACILITY	DATE 03/91	FACILITY PLATE NO. 211-82	SHEET 5 OF 6

NOTES

PLUMBING REQUIREMENTS

COLD WATER	30 GPM
HOT WATER	
RECOVERY RATE (100°RISE)	30 GPH
STORAGE	30 GAL

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (MBTU/HR)

INSIDE DESIGN TEMPERATURE 70°F

OUTSIDE DESIGN TEMPERATURE

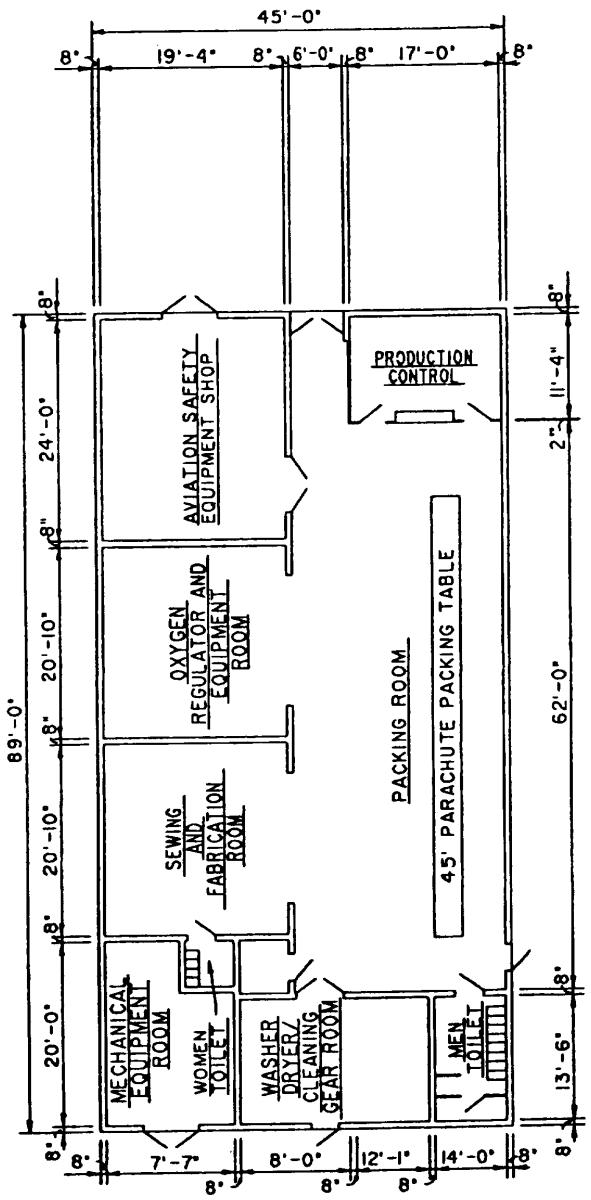
	-5 F°	+5 F°	+15 F°	+25 F°
2 BAYS	702	605	516	426
3 BAYS	1050	906	772	631
4 BAYS	1400	1207	1057	840

ELECTRICAL REQUIREMENTS (KW)

	2 BAYS	3 BAYS	4 BAYS
LIGHTS			
CONNECTED LOAD	36.5	54.6	72.7
ESTIMATED DEMAND	28.4	42.4	56.5
POWER			
CONNECTED LOAD	230.0	330.0	420.0
ESTIMATED DEMAND	184.0	264.0	336.0
TOTAL			
CONNECTED LOAD	266.5	384.6	492.7
ESTIMATED DEMAND	212.4	306.4	392.5

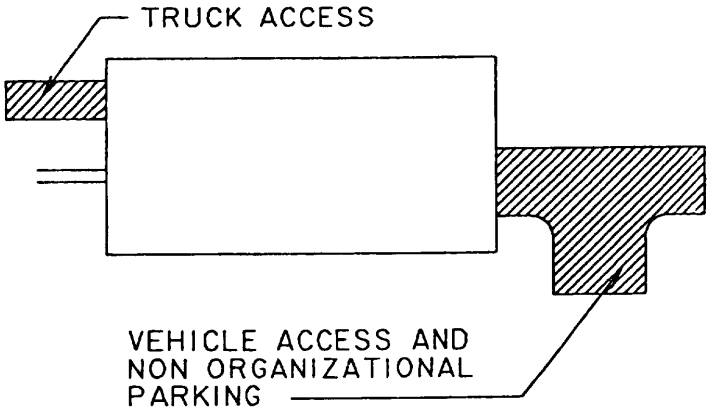
AREAS	2 BAYS	3 BAYS	4 BAYS
GROSS AREA INCLUDING MECHANICAL ROOM AND EQUIPMENT ROOM	10,423 SF	15,503 SF	20,583 SF

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AIRCRAFT WEAPONS ALIGNMENT FACILITY	03/91	211-82	6 OF 6



FLOOR PLAN
NOT TO SCALE

TITLE: AVIATION LIFE SUPPORT SYSTEMS SHOP	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE:	AVIATION LIFE SUPPORT SYSTEMS SHOP	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 2 OF 3

NOTES .

PLUMBING REQUIREMENTS

COLD WATER	100 G.P.M.
HOT WATER	
RECOVERY RATE (100° RISE)	50 G.P.H.
STORAGE	70 GAL.

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (MBTU/HR)

OUTSIDE DESIGN TEMPERATURE

-5° F	+5° F	+15° F	+25° F
255	220	185	150

AIR CONDITIONING REQUIREMENTS

COOLING LOAD (MBTU/HR)	246

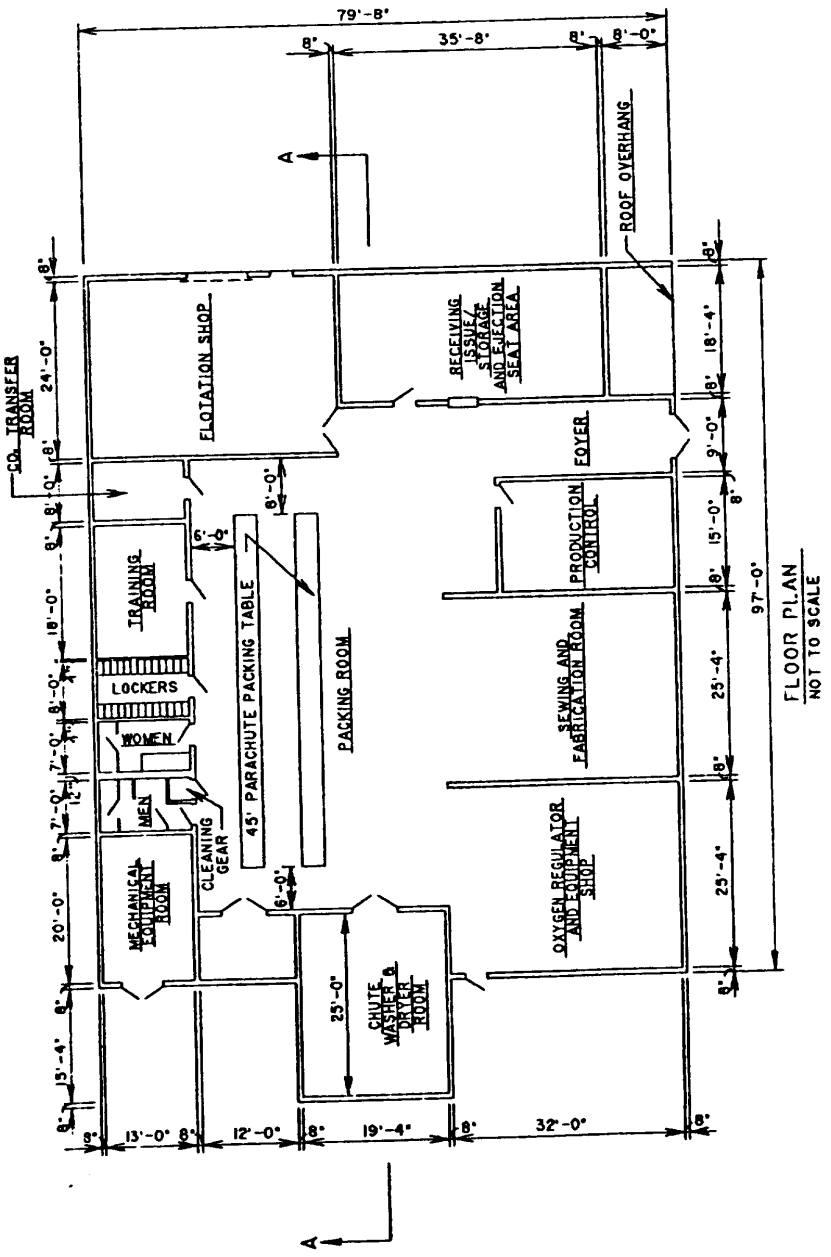
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	15.0
ESTIMATED DEMAND	12.0
POWER	
CONNECTED LOAD	12.5
ESTIMATED DEMAND	10.0
TOTAL	
CONNECTED LOAD	27.5
ESTIMATED DEMAND	22.0
ADDITIONAL DEMAND FOR AIR CONDITIONING	20.5

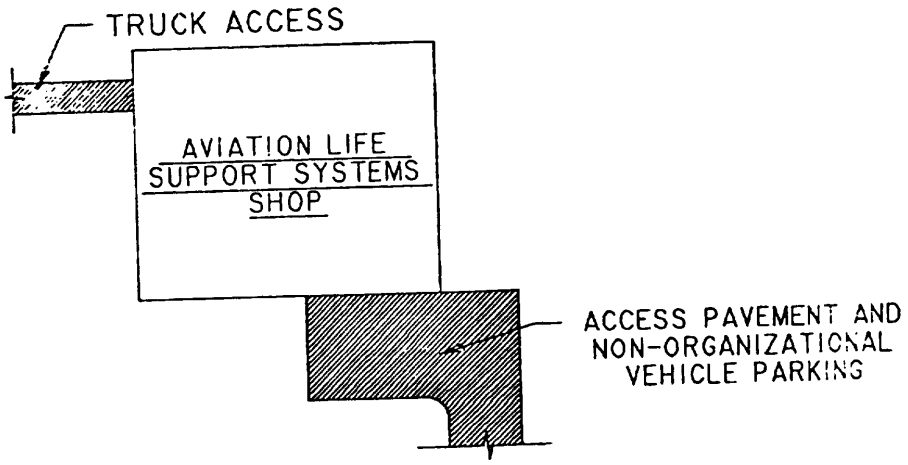
AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	4,000 S.F.

TITLE: AVIATION LIFE SUPPORT SYSTEMS SHOP	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 3 OF 3



TITLE: AVIATION LIFE SUPPORT SYSTEMS SHOP	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIATION LIFE SUPPORT SYSTEMS SHOP	03/91	211-75	2 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	100 G.P.M.
HOT WATER	
RECOVERY RATE (100° RISE)	70 G.P.H.
STORAGE	90 GAL.

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (MBTU/HR)

OUTSIDE DESIGN TEMPERATURE

-5° F	+5° F	+15° F	+25° F
305	261	219	178

AIR CONDITIONING REQUIREMENTS

COOLING LOAD (MBTU/HR)	336

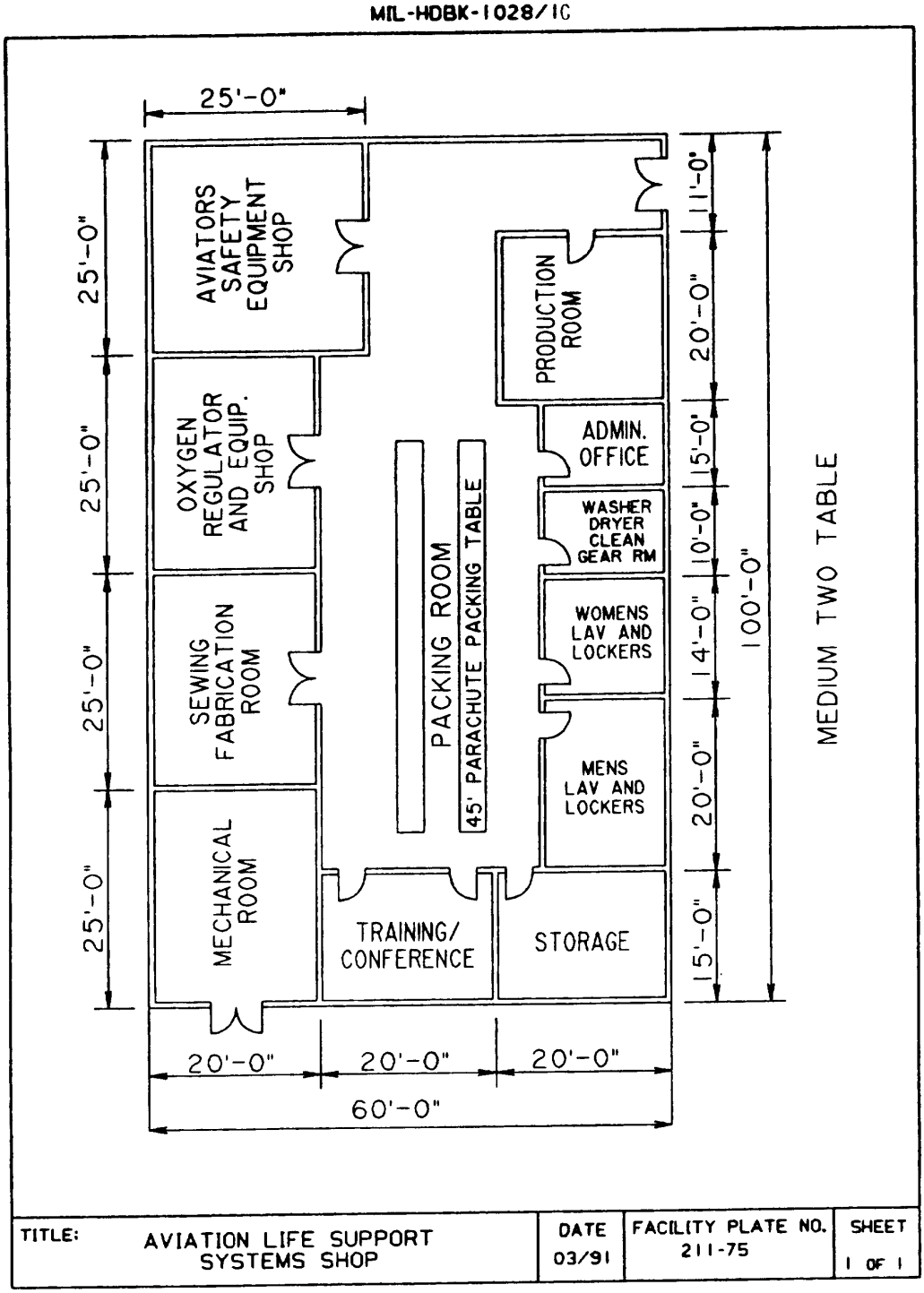
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	17.6
ESTIMATED DEMAND	14.2
POWER	
CONNECTED LOAD	14.8
ESTIMATED DEMAND	11.9
TOTAL	
CONNECTED LOAD	32.6
ESTIMATED DEMAND	26.1
ADDITIONAL DEMAND FOR AIR CONDITIONING	28.0

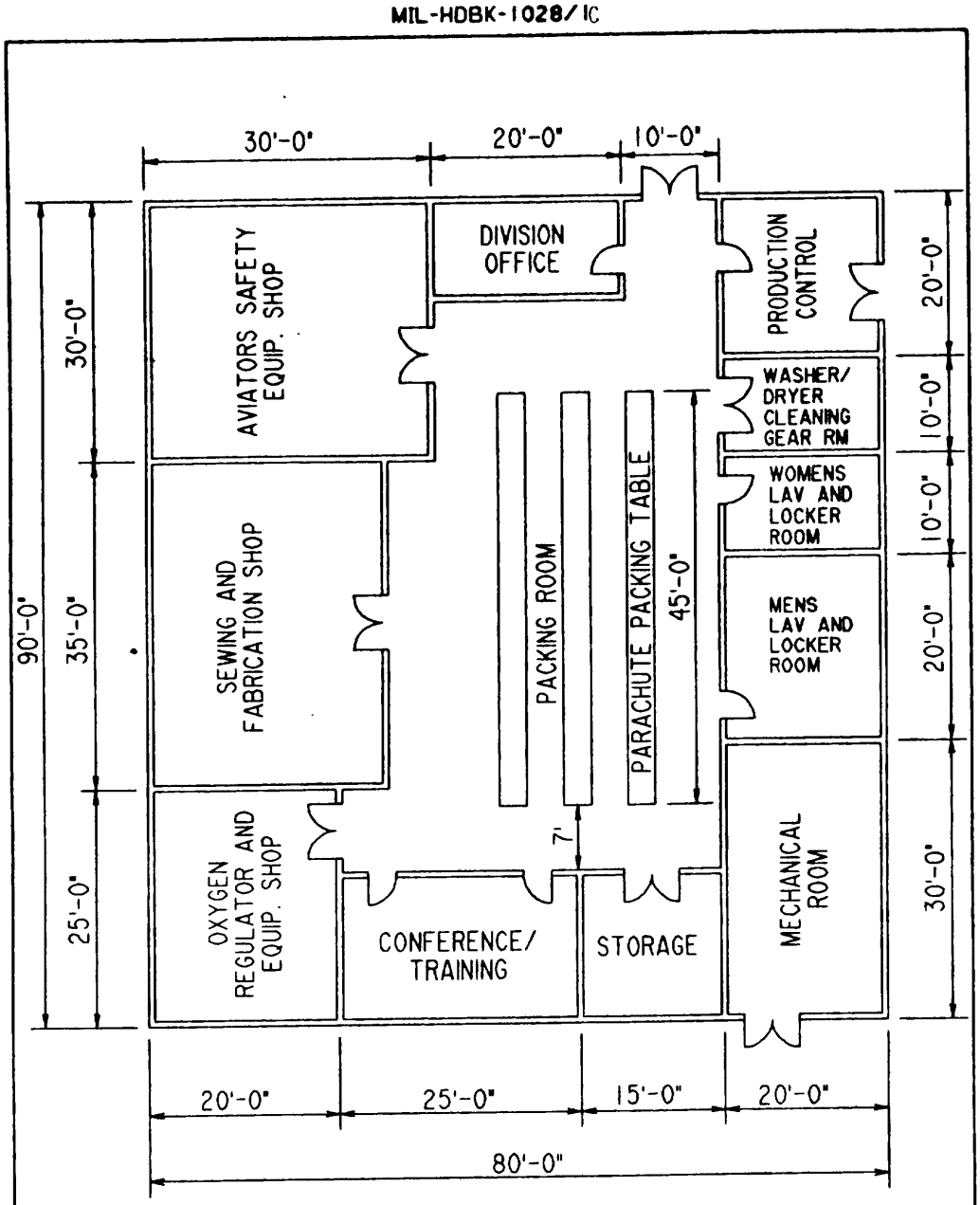
AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	7,800 S.F.

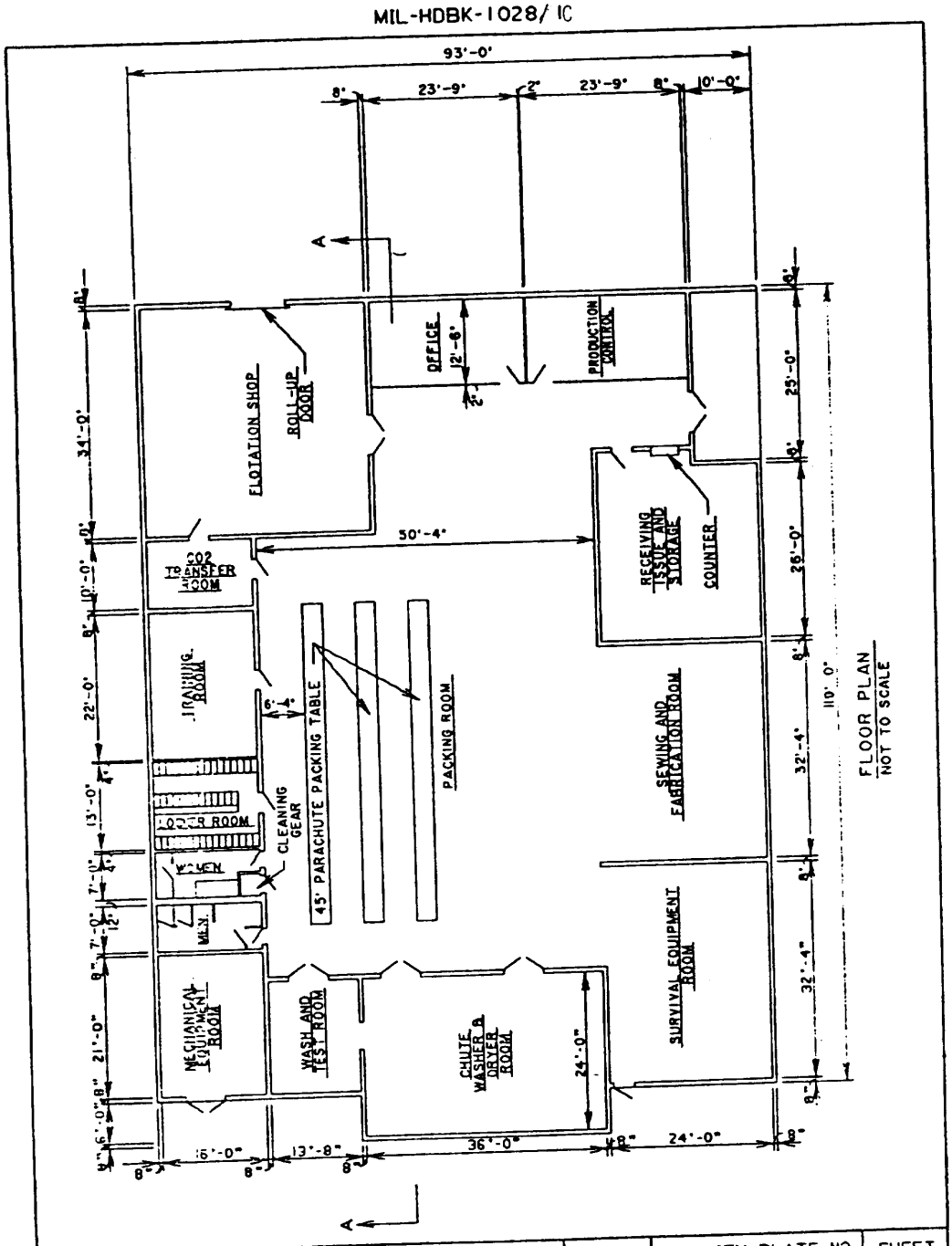
TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIATION LIFE SUPPORT SYSTEMS SHOP	03/91	211-75	3 OF 3



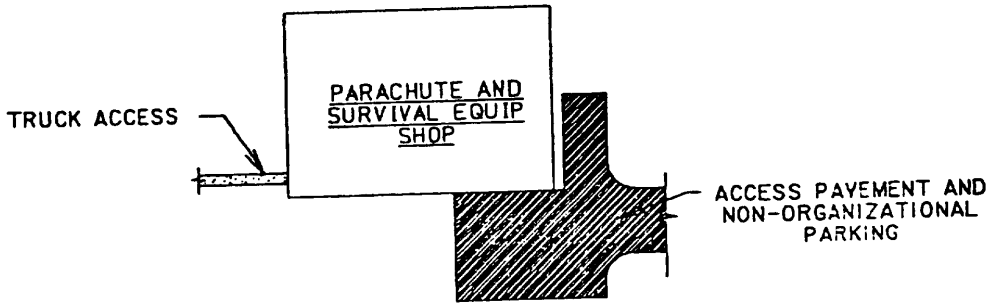
TITLE: AVIATION LIFE SUPPORT SYSTEMS SHOP	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 1 OF 1



TITLE: AVIATION LIFE SUPPORT SYSTEMS SHOP	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 1 OF 1



TITLE: AVIATION LIFE SUPPORT SYSTEMS SHOP - LARGE	DATE 03/91	FACILITY PLATE NO. 211-75	SHEET 1 OF 3



TYPICAL SITE PLAN
NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIATION LIFE SUPPORT SYSTEMS SHOP - LARGE	03/91	211-75	2 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	30 G.P.M.
HOT WATER	
RECOVERY RATE (100° RISE)	75 G.P.H.
STORAGE	110 GAL.

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (MBTU/HR)

OUTSIDE DESIGN TEMPERATURE

-5° F	+5° F	+15° F	+25° F
589	508	427	347

AIR CONDITIONING REQUIREMENTS

COOLING LOAD (MBTU/HR)	504

ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	34.6
ESTIMATED DEMAND	27.7
POWER	
CONNECTED LOAD	28.9
ESTIMATED DEMAND	23.1
TOTAL	
CONNECTED LOAD	63.5
ESTIMATED DEMAND	50.8
ADDITIONAL DEMAND FOR AIR CONDITIONING	42.0

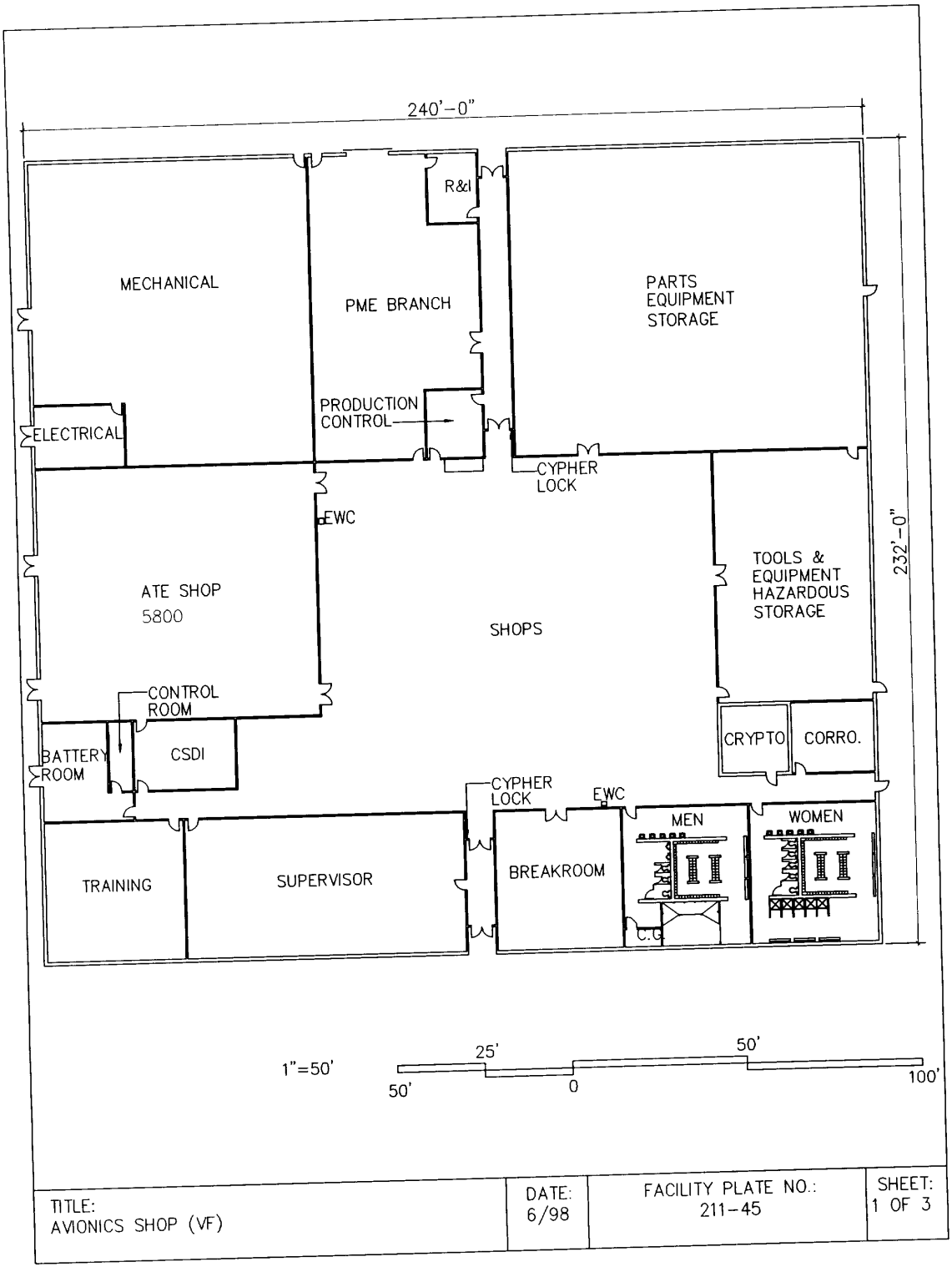
AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	11,200 S.F.

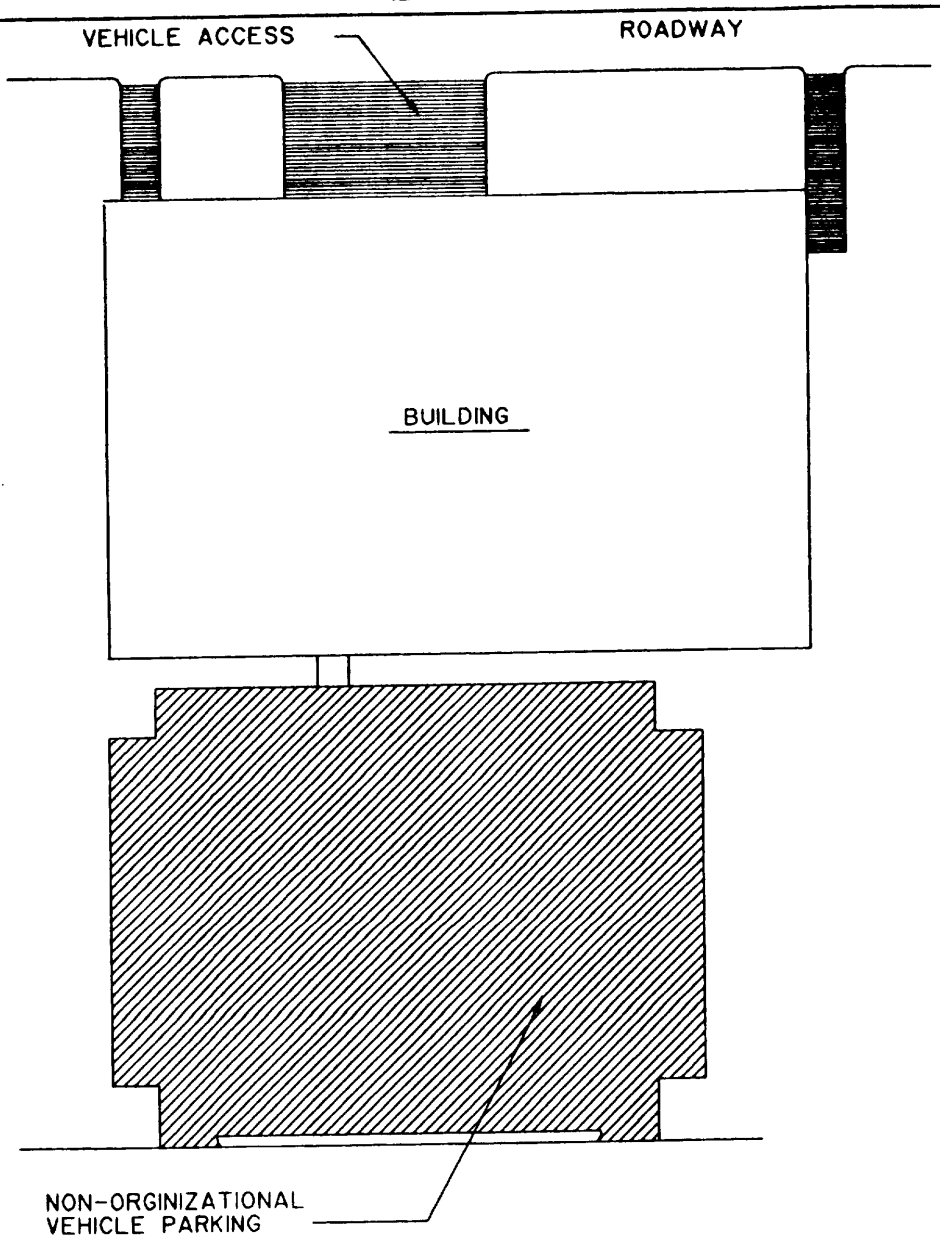
GENERAL NOTES:

RELOCATABLE PARTITIONS ARE DESIGNATED AS 2" PARTITIONS. ACTUAL DIMENSIONS WILL BE A FUNCTION OF DESIGN.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIATION LIFE SUPPORT SYSTEMS SHOP - LARGE	03/91	211-75	3 OF 3



TITLE: AVIONICS SHOP (VF)	DATE: 6/98	FACILITY PLATE NO.: 211-45	SHEET: 1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AVIONICS SHOP VF	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 2 OF 3

NOTES

PLUMBING REQUIREMENTS
- COLD WATER — 110 G.P.M.
- HOT WATER
  - RECOVERY RATE (100°F RISE) — 100 G.P.H.
  - STORAGE — 140 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)
OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25
920	788	657	525

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F W.B. OUTSIDE DESIGN CONDITIONS
COOLING LOAD (MBH) — 922

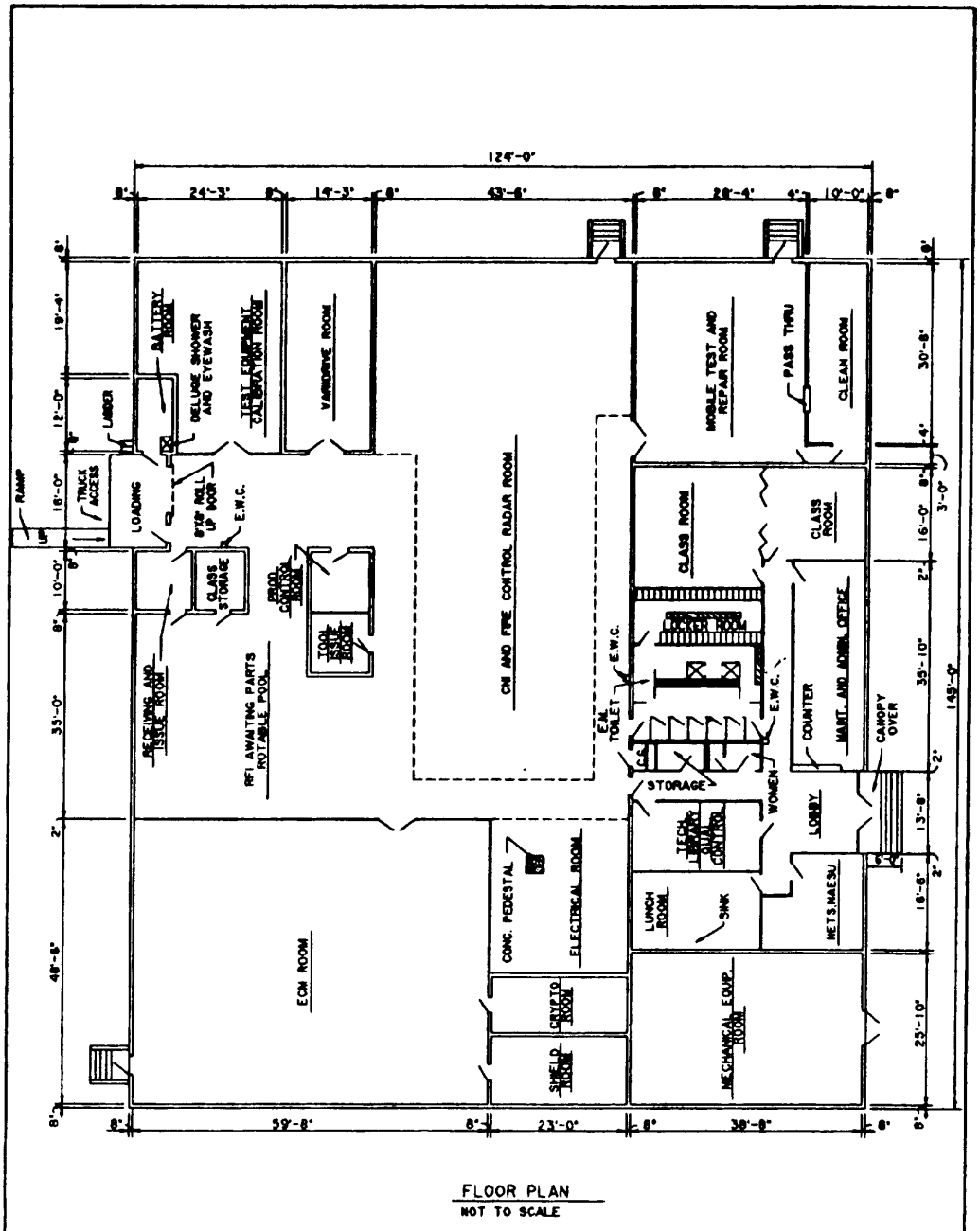
EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	177.8
ESTIMATED DEMAND	166.7
POWER	
CONNECTED LOAD	1278.1
ESTIMATED DEMAND	766.7
TOTAL	
CONNECTED LOAD	1455.9
ESTIMATED DEMAND	933.4
AIR CONDITIONING	99.7

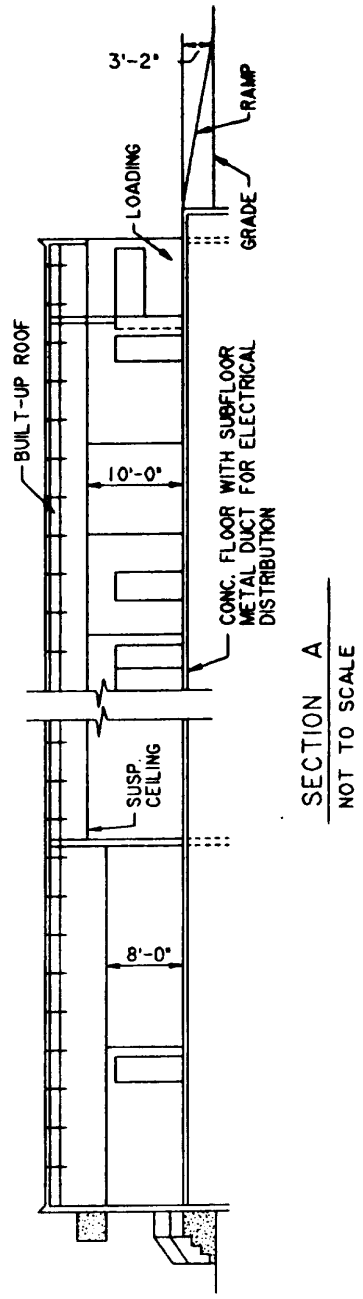
AREAS (SQUARE FEET)
GROSS AREA INCLUDING MECHANICAL EQUIPMENT — 55,700

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
AVIONICS SHOP (VF)	12/97	211-45	3 OF 3



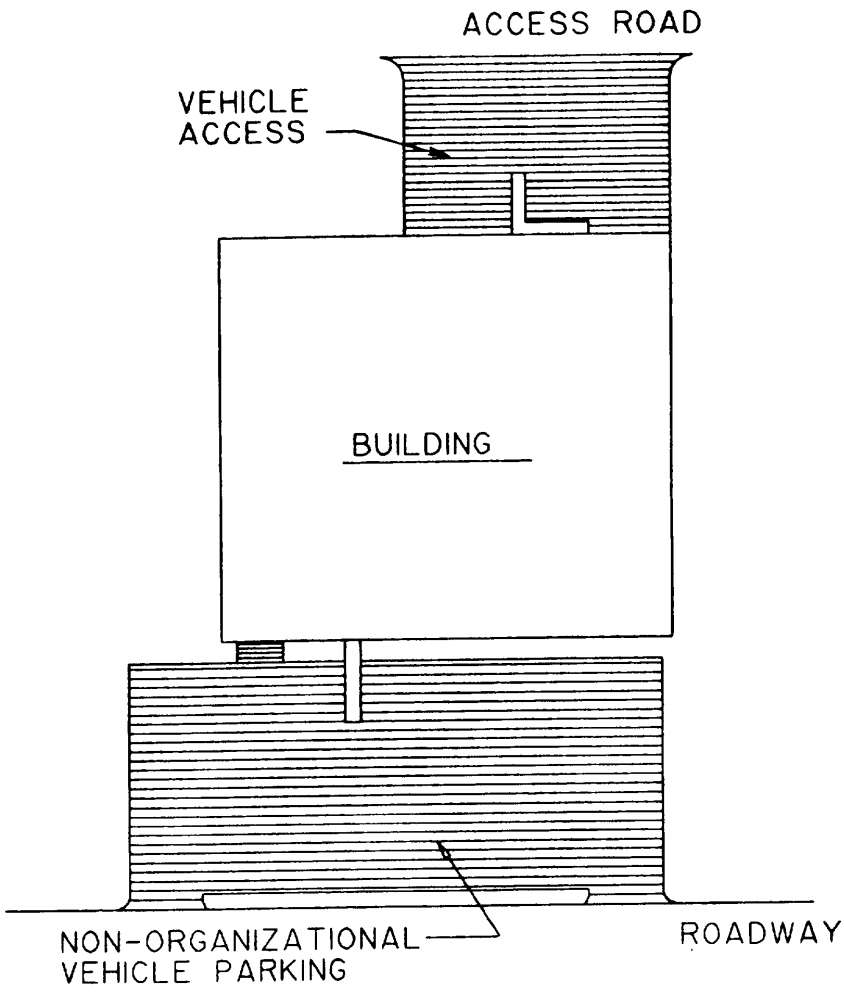
FLOOR PLAN
NOT TO SCALE

TITLE: AVIONICS SHOP VF	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 1 OF 4



SECTION A
NOT TO SCALE

TITLE: AVIONICS SHOP VF	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 2 OF 4



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AVIONICS SHOP VF	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 3 OF 4

NOTES

PLUMBING REQUIREMENTS

WATER

COLD	76 G.P.M.
HOT	
RECOVERY RATE (100°RISE)	75 G.P.H.
STORAGE	75 G.P.H.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
295	253	211	169

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH) 297

HEAT REJECTED TO CONDITIONED SPACES BY ENERGIZED TEST

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

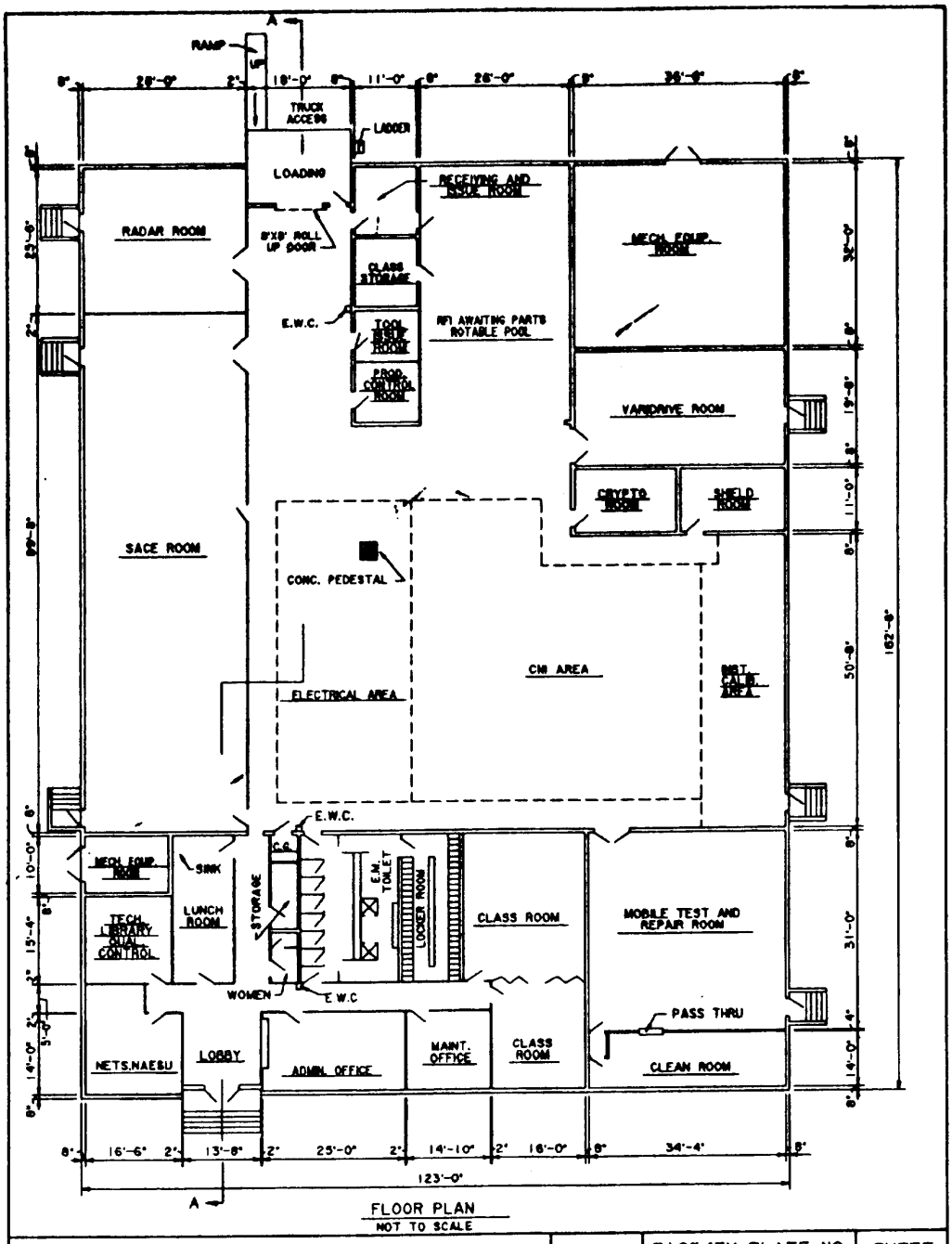
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	57.6
ESTIMATED DEMAND	54.0
POWER	
CONNECTED LOAD	414.0
ESTIMATED DEMAND	248.4
TOTAL	
CONNECTED LOAD	471.6
ESTIMATED DEMAND	302.4
AIR CONDITIONING	32.1

AREAS

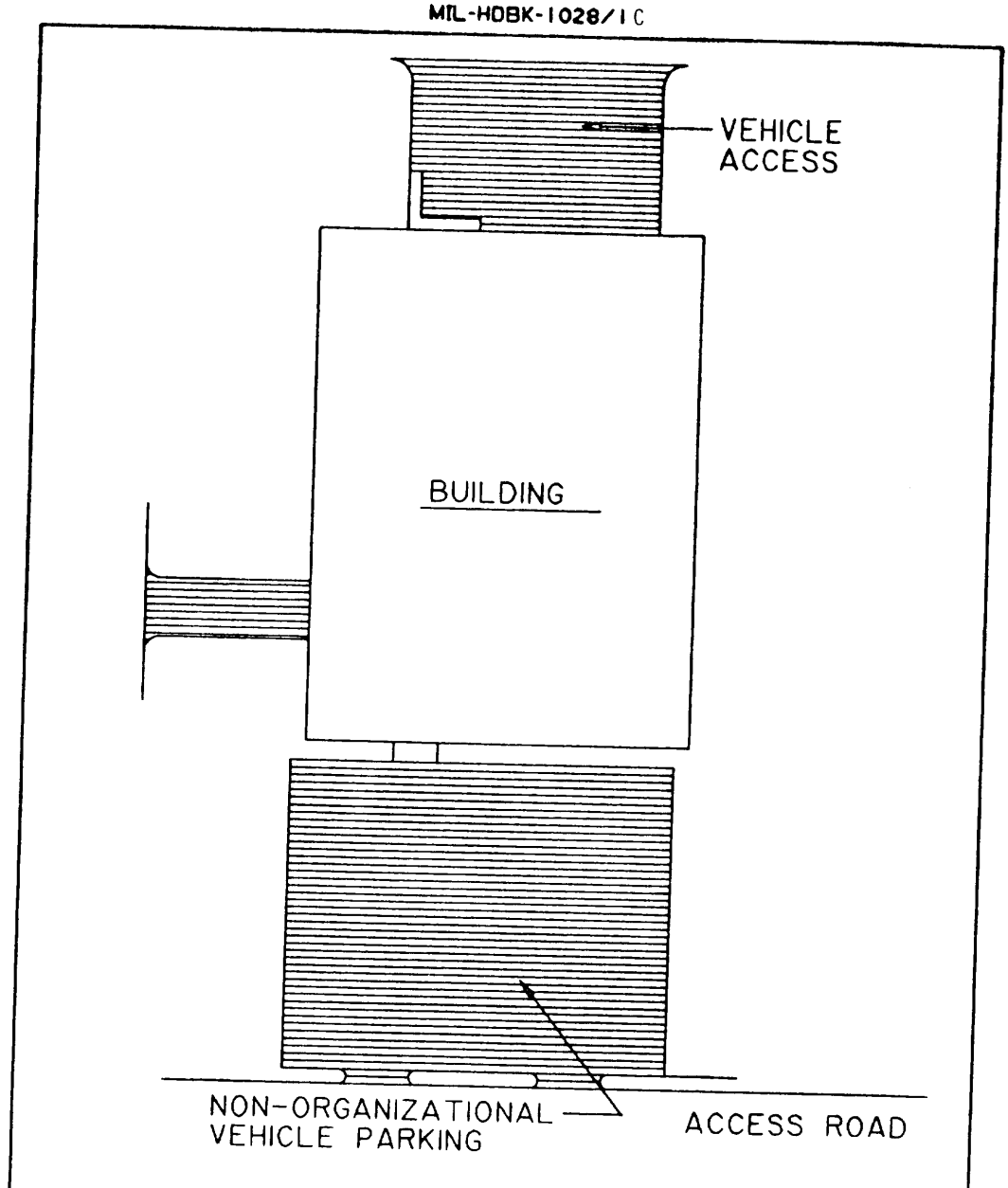
GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM 18,000 S.F.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VF	03/91	211-45	4 OF 4



FLOOR PLAN
NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VW	03/91	211-45	1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VW	03/91	211-45	2 OF 3

NOTES

PLUMBING REQUIREMENTS

WATER	
COLD	83 G.P.M.
HOT	
RECOVERY RATE (100°RISE)	85 G.P.H.
STORAGE	85 G.P.H.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
329	282	235	188

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	330

HEAT REJECTED TO CONDITIONED SPACES BY ENERGIZED TEST

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

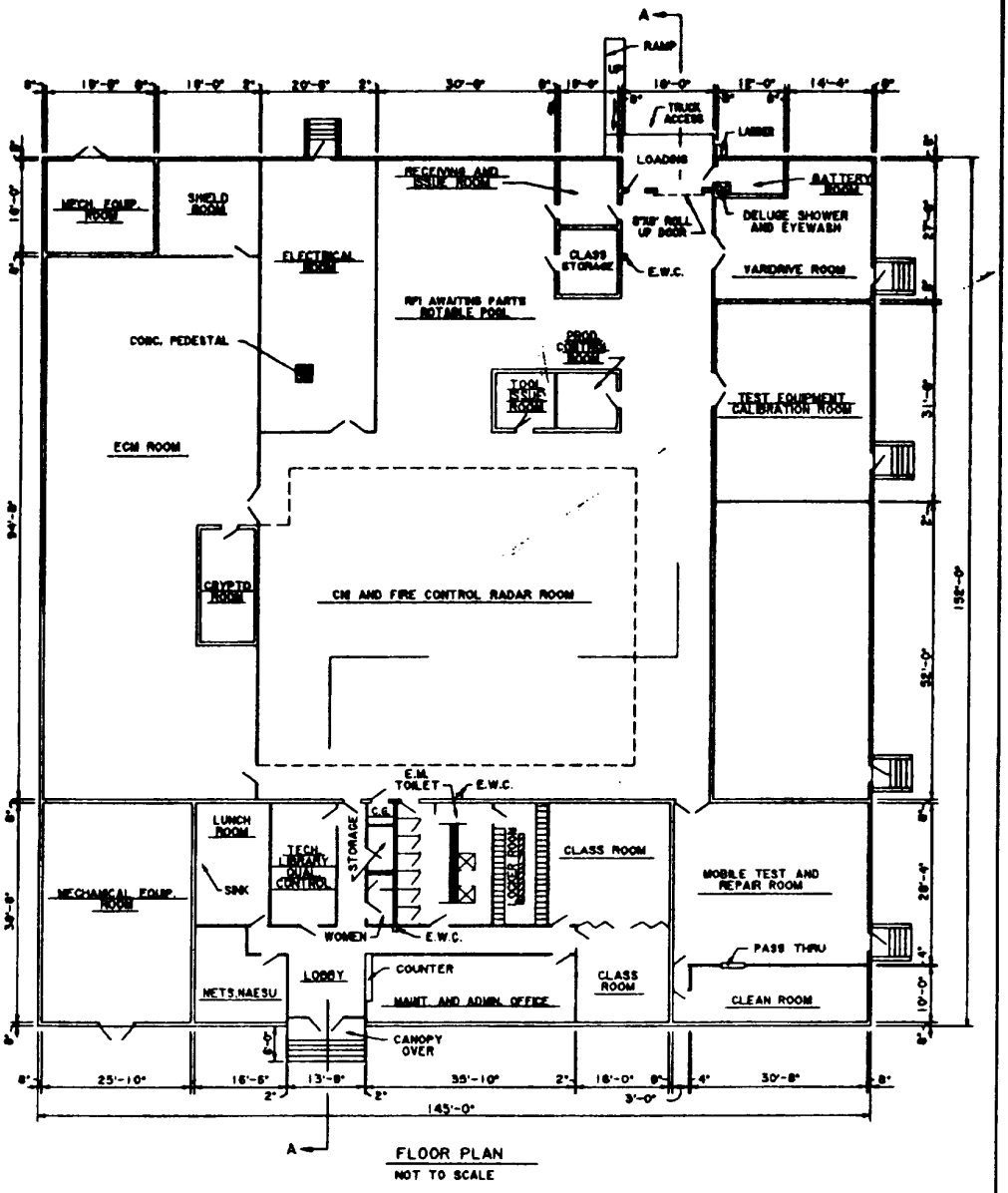
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	64.0
ESTIMATED DEMAND	80.0
POWER	
CONNECTED LOAD	460.0
ESTIMATED DEMAND	276.0
TOTAL	
CONNECTED LOAD	524.0
ESTIMATED DEMAND	336.0
AIR CONDITIONING	35.8

AREAS

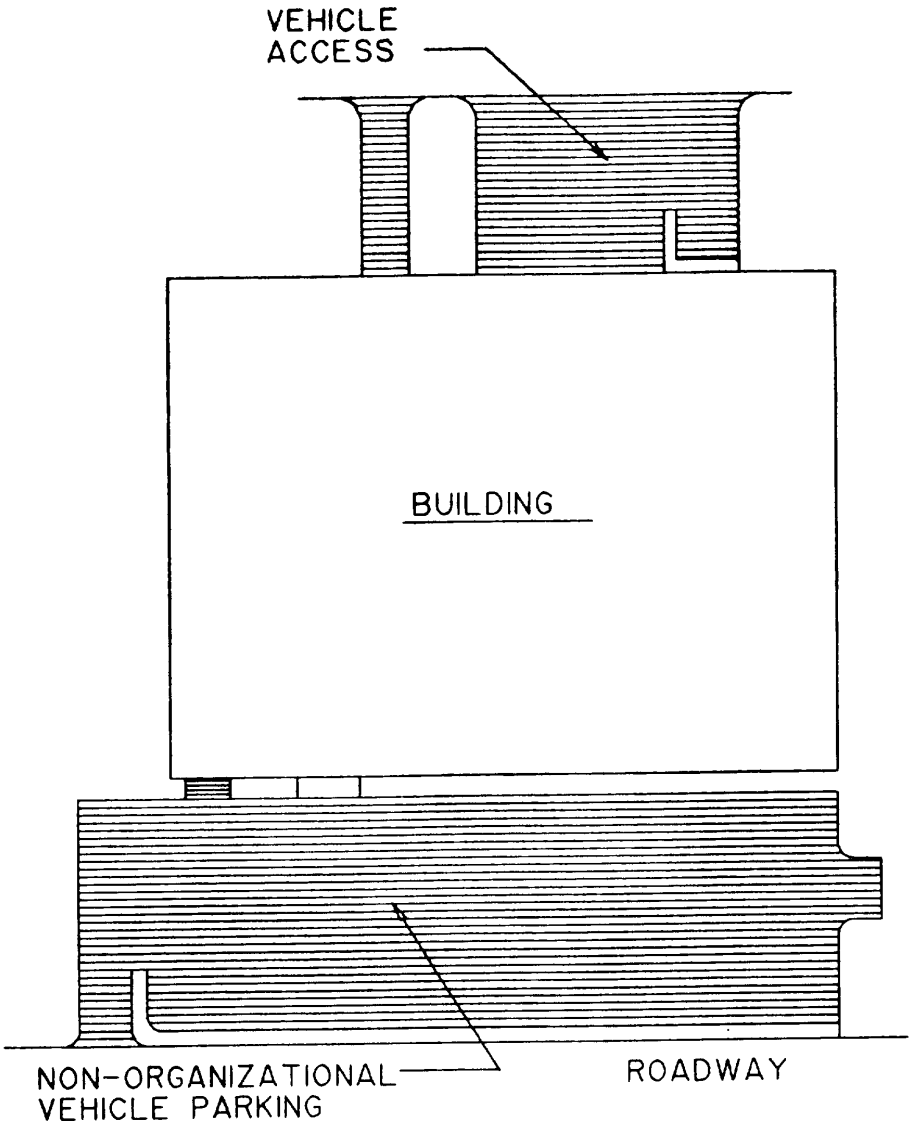
GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	20,000 S.F.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VW	03/91	211-45	3 OF 3



FLOOR PLAN
NOT TO SCALE

TITLE: AVIONICS SHOP VA	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AVIONICS SHOP VA	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 2 OF 3

NOTES

PLUMBING REQUIREMENTS

WATER	
COLD	76 G.P.M.
HOT	
RECOVERY RATE (100°RISE)	75 G.P.H.
STORAGE	75 G.P.H.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
362	311	259	207

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	363

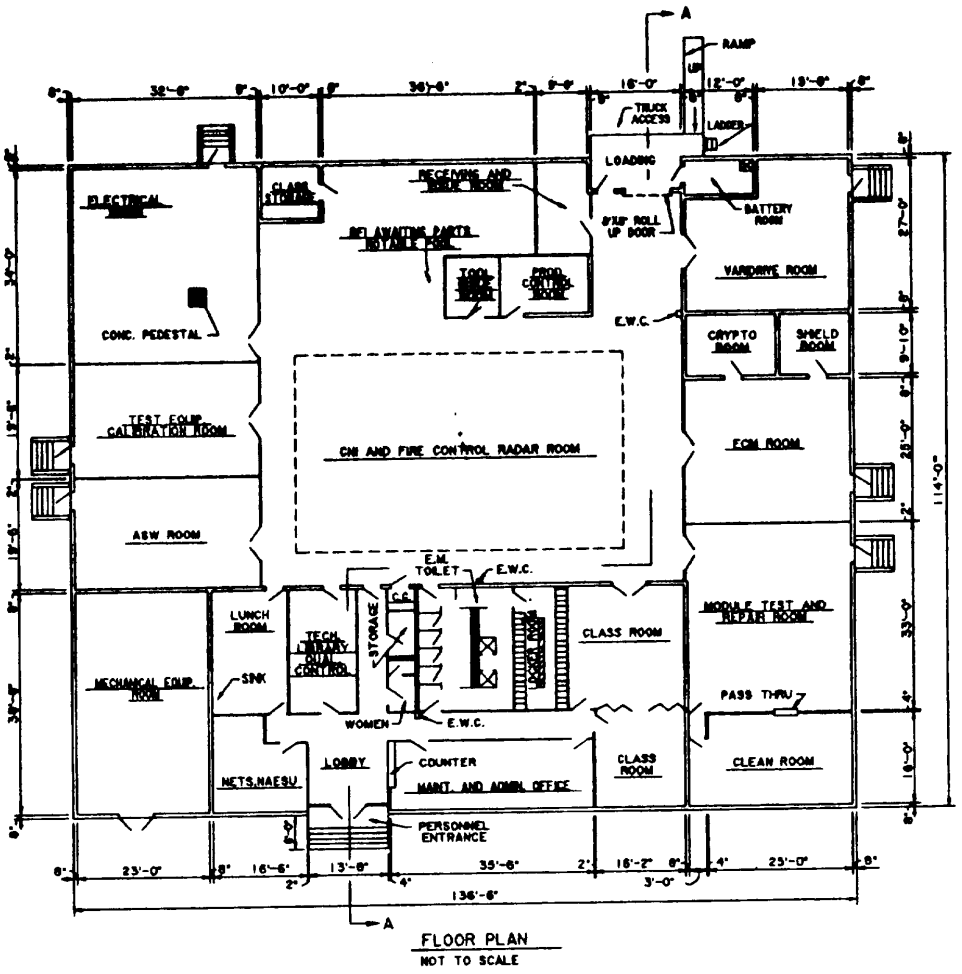
HEAT REJECTED TO CONDITIONED SPACES BY ENERGIZED TEST

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

ELECTRICAL REQUIREMENTS (KW)

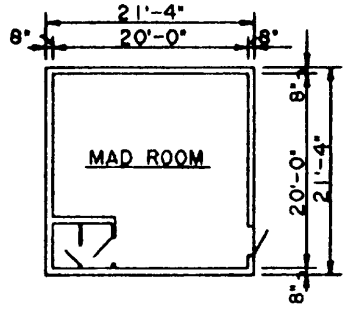
LIGHTS	
CONNECTED LOAD	70.4
ESTIMATED DEMAND	66.0
POWER	
CONNECTED LOAD	506.0
ESTIMATED DEMAND	303.6
TOTAL	
CONNECTED LOAD	576.4
ESTIMATED DEMAND	369.6
AIR CONDITIONING	39.4
AREAS	
GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	22,000 S.F.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VA	03/91	211-45	3 OF 3

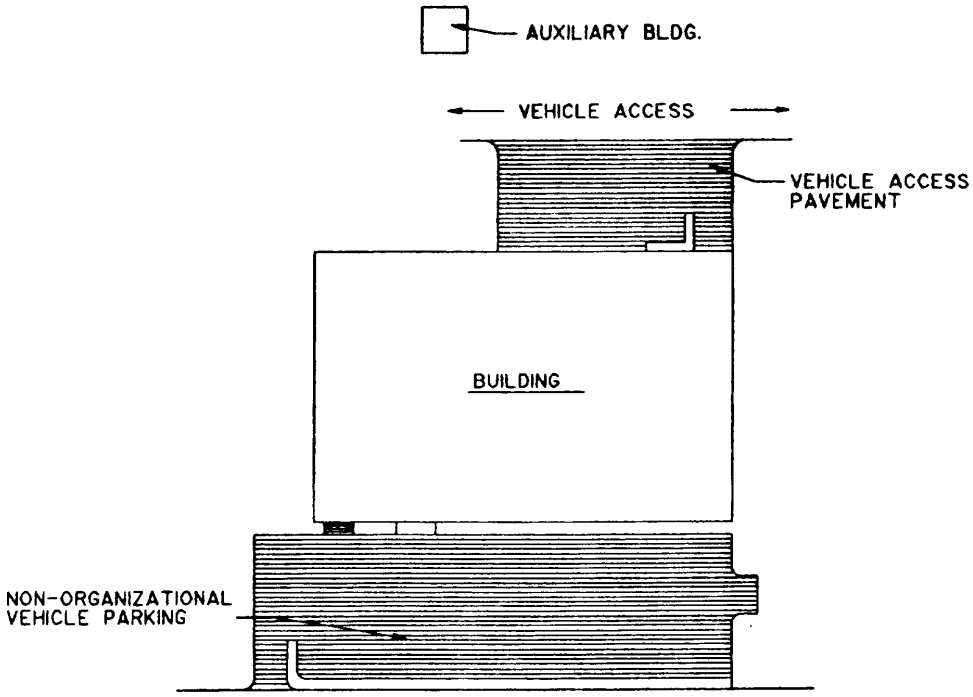


FLOOR PLAN
NOT TO SCALE

TITLE: AVIONICS SHOP VP/VS/VR	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 1 OF 3



AUXILIARY BUILDING
SCALE: 3/32"=1'-0"



TYPICAL SITE PLAN
NOT TO SCALE

TITLE: AVIONICS SHOP VP/VS/VR	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 2 OF 3

NOTES

PLUMBING REQUIREMENTS

WATER

COLD	76 G.P.M.
HOT	
RECOVERY RATE (100°RISE)	75 G.P.H.
STORAGE	75 G.P.H.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
257	221	184	147

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	258

HEAT REJECTED TO CONDITIONED SPACES BY ENERGIZED TEST

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

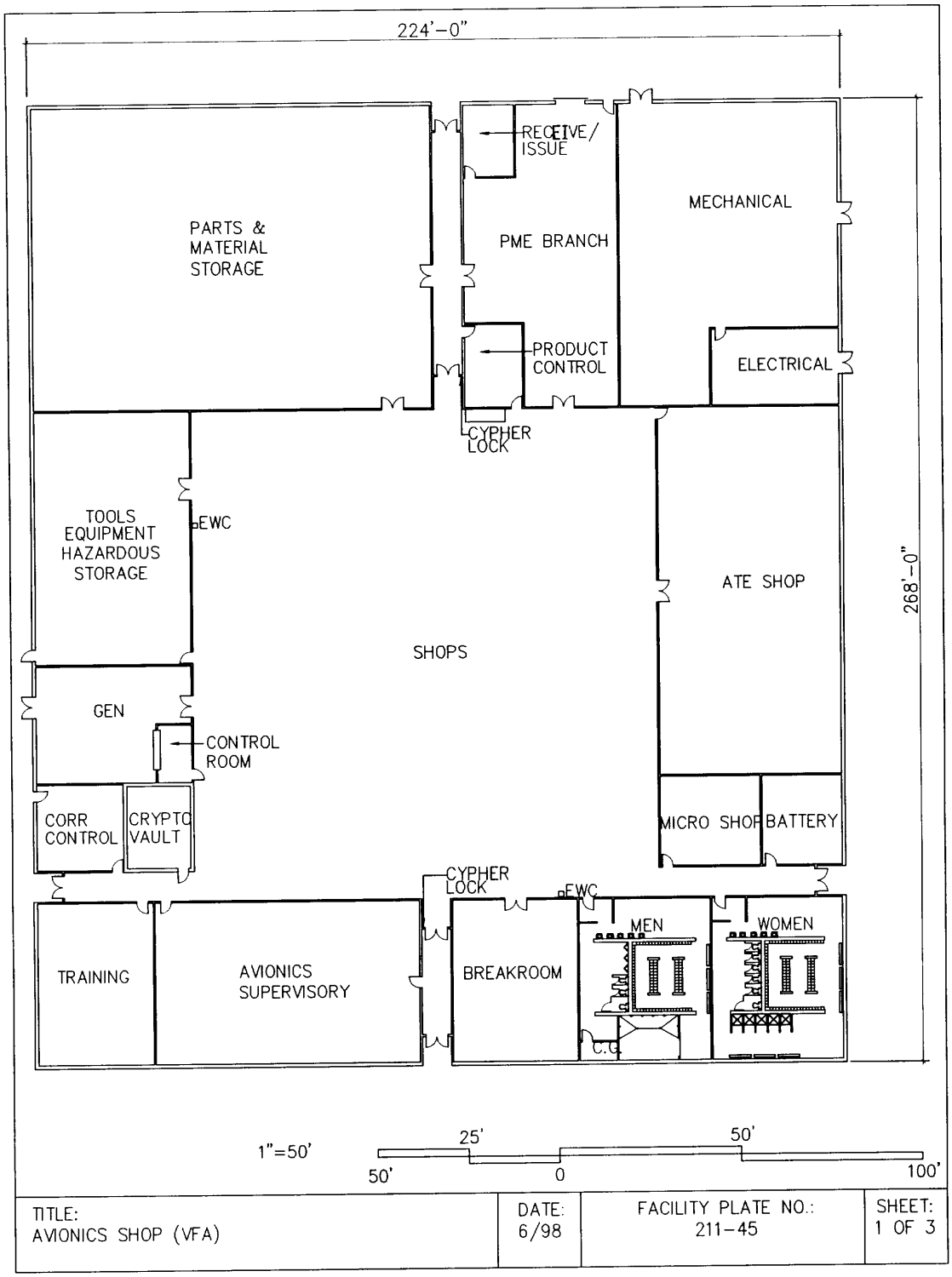
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	49.9
ESTIMATED DEMAND	46.8
POWER	
CONNECTED LOAD	358.8
ESTIMATED DEMAND	215.3
TOTAL	
CONNECTED LOAD	406.7
ESTIMATED DEMAND	262.1
AIR CONDITIONING	27.9

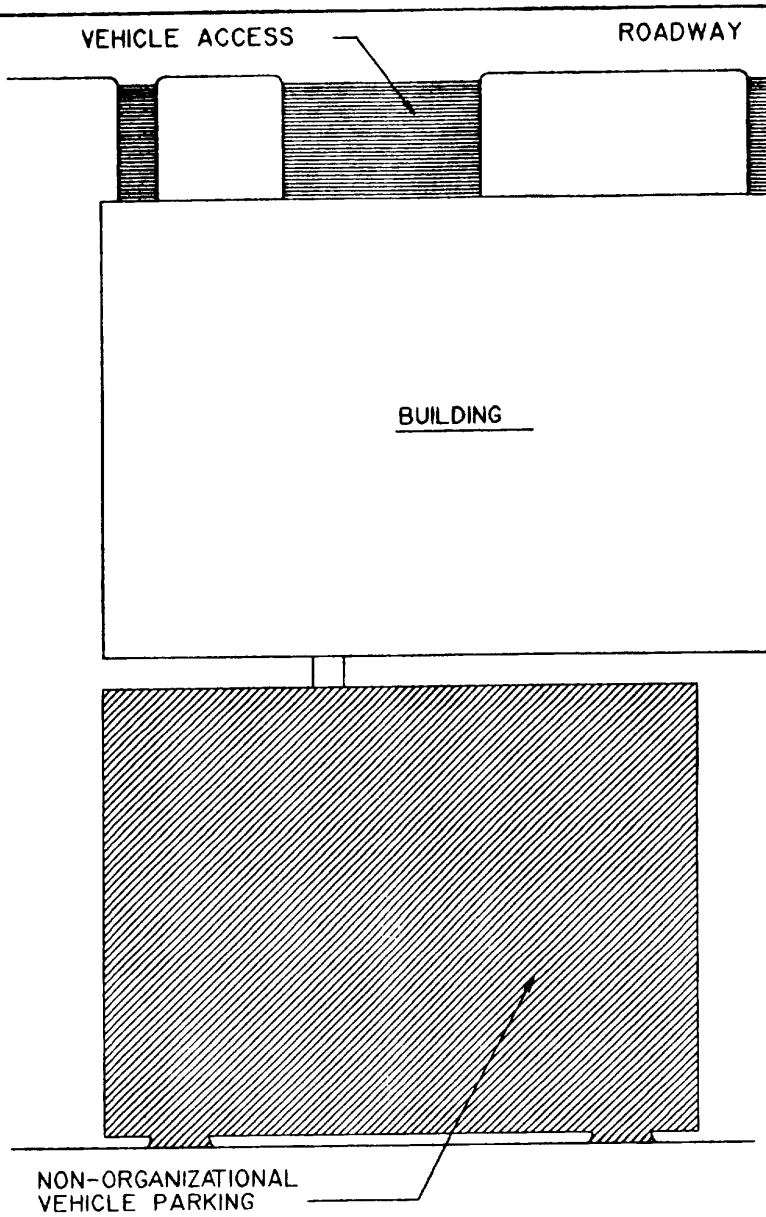
AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM	15,600 S.F.
AUXILIARY BUILDING	400 S.F.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VP/VS/VR	03/91	211-45	3 OF 3



TITLE: AVIONICS SHOP (VFA)	DATE: 6/98	FACILITY PLATE NO.: 211-45	SHEET: 1 OF 3



TYPICAL SITE PLAN

NOT TO SCALE

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VA	03/91	211-45	2 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	120 G.P.M.
HOT WATER	
RECOVERY RATE (100°F RISE)	130 G.P.H.
STORAGE	160 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)
OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25
990	848	707	565

AIR CONDITIONING REQUIREMENTS
BASED ON 91°F D.B. 76°F W.B. OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	992

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

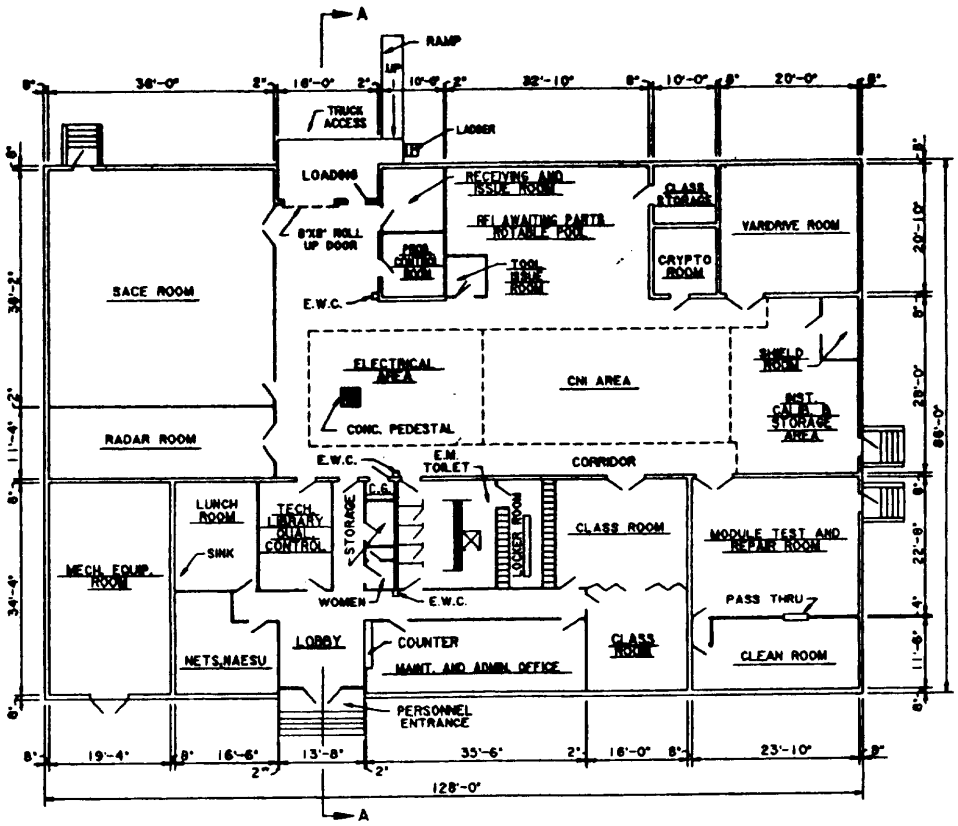
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	191.9
ESTIMATED DEMAND	179.9
POWER	
CONNECTED LOAD	1379.6
ESTIMATED DEMAND	827.6
TOTAL	
CONNECTED LOAD	1571.5
ESTIMATED DEMAND	1007.5
AIR CONDITIONING	107.3

AREAS (SQUARE FEET)

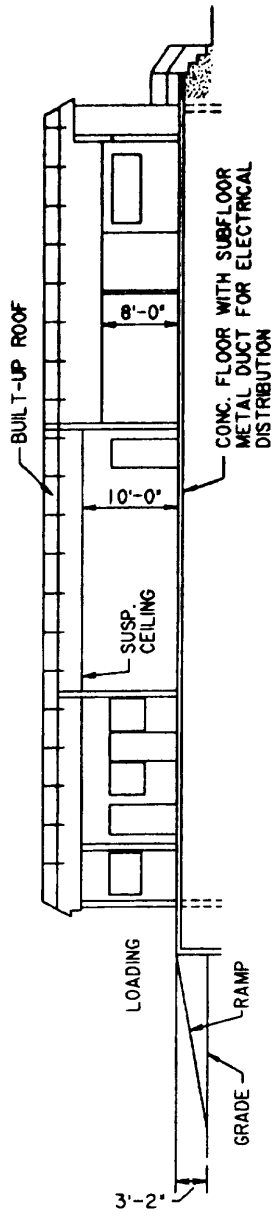
GROSS AREA INCLUDING MECHANICAL EQUIPMENT	60,000

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
AVIONICS SHOP (VFA)	12/97	211-45	3 OF 3



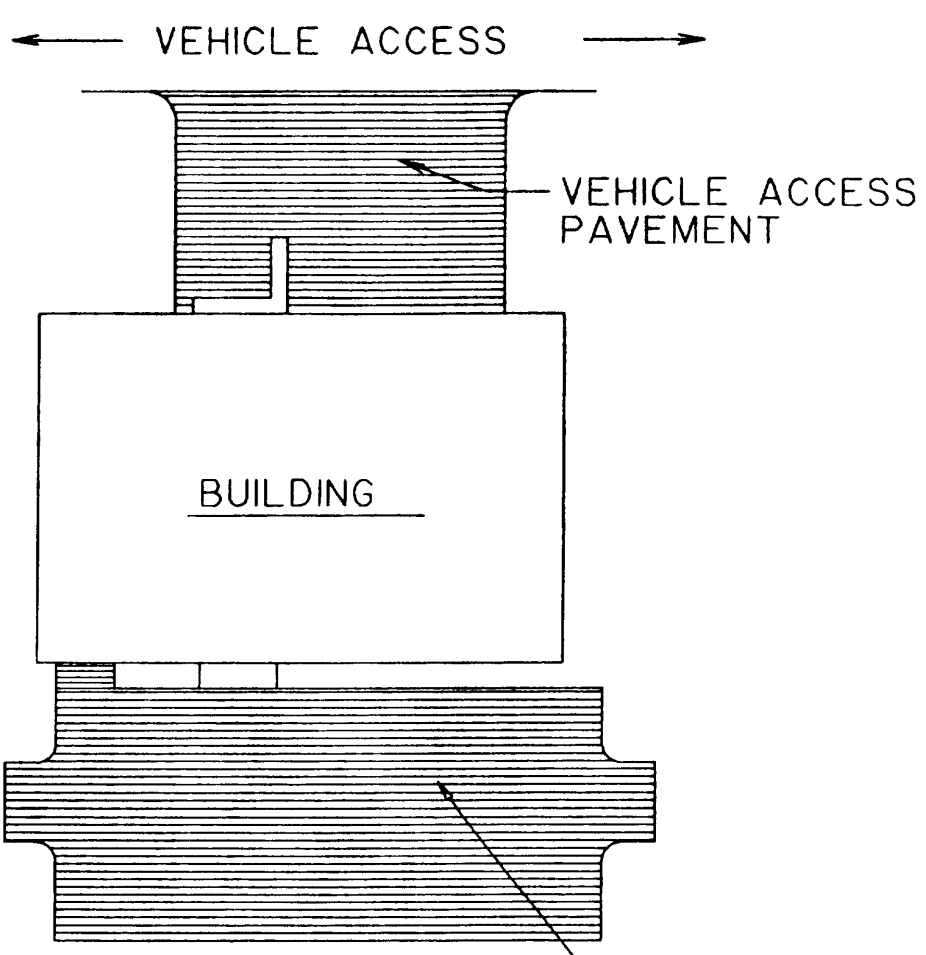
FLOOR PLAN
NOT TO SCALE

TITLE: AVIONICS SHOP VW	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 1 OF 4



SECTION A
NOT TO SCALE

TITLE: AVIONICS SHOP VW	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 2 OF 4



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AVIONICS SHOP VW	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 3 OF 4

NOTES

PLUMBING REQUIREMENTS

WATER	
COLD	68 G.P.M.
HOT	
RECOVERY RATE (100°RISE)	62 G.P.H.
STORAGE	62 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
182	156	130	104

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F WB OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH) 182

HEAT REJECTED TO CONDITIONED SPACES BY ENERGIZED TEST

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

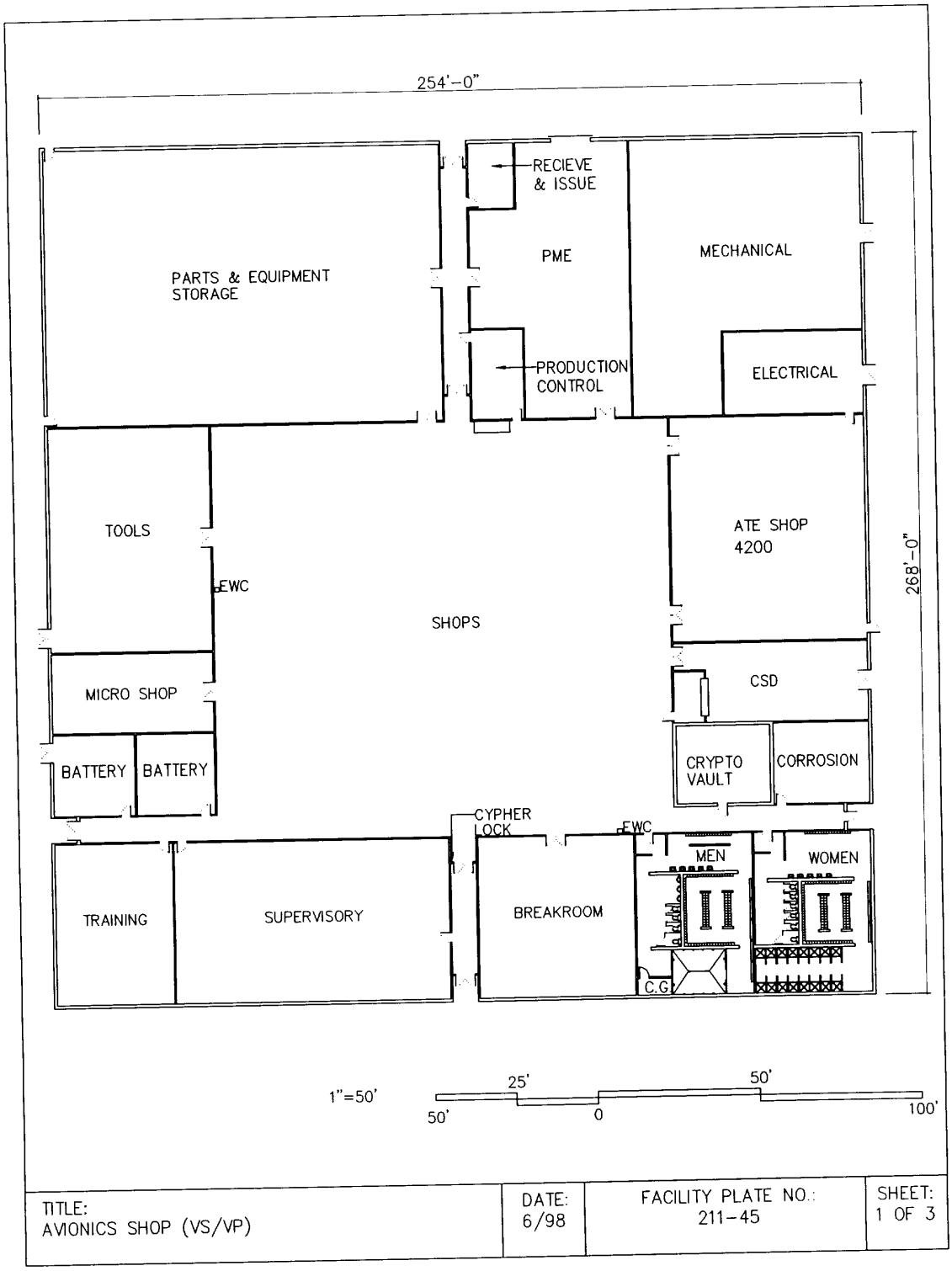
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	35.2
ESTIMATED DEMAND	33.0
POWER	
CONNECTED LOAD	253.0
ESTIMATED DEMAND	151.8
TOTAL	
CONNECTED LOAD	288.2
ESTIMATED DEMAND	184.8
AIR CONDITIONING	19.7

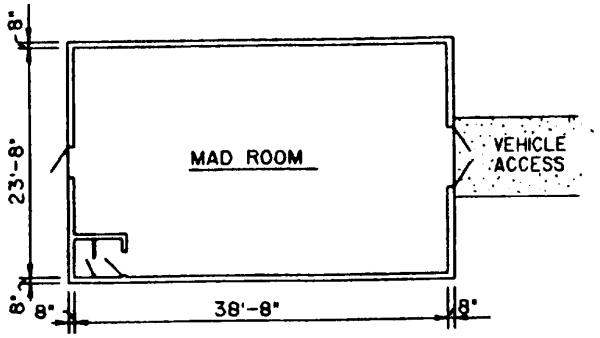
AREAS

GROSS AREA INCLUDING MECHANICAL EQUIPMENT ROOM 11,000 S.F.

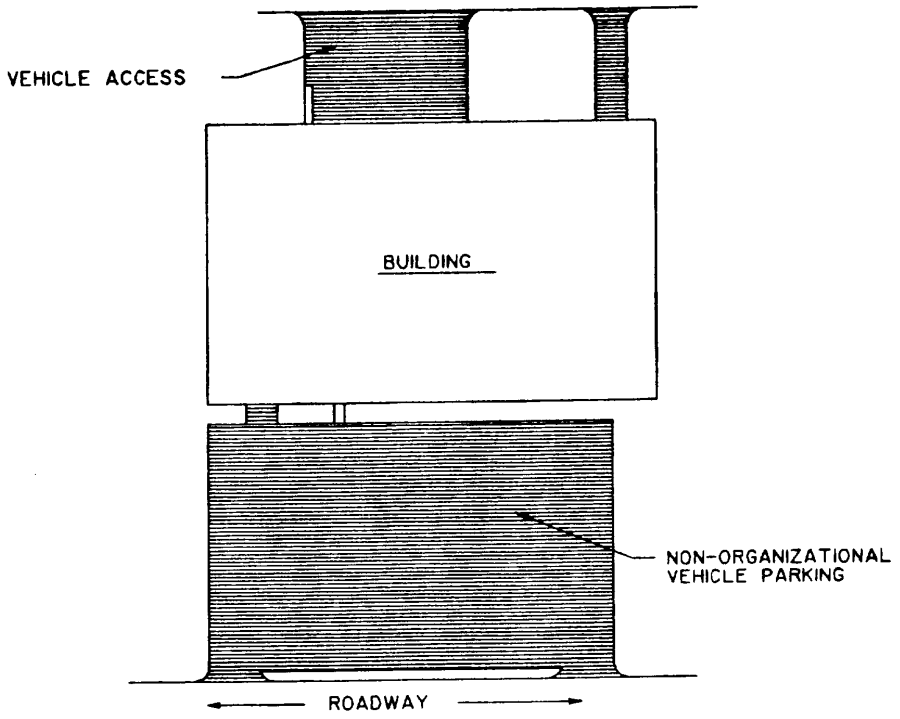
TITLE:	DATE	FACILITY PLATE NO.	SHEET
AVIONICS SHOP VW	03/91	211-45	4 OF 4



TITLE: AVIONICS SHOP (VS/VP)	DATE: 6/98	FACILITY PLATE NO.: 211-45	SHEET: 1 OF 3



AUX. BLDG. FLOOR PLAN



TYPICAL SITE PLAN
NOT TO SCALE

TITLE: AVIONICS SHOP VP/VS/VR	DATE 03/91	FACILITY PLATE NO. 211-45	SHEET 2 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	130 G.P.M.
HOT WATER	
RECOVERY RATE (100°F RISE)	130 G.P.H.
STORAGE	200 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)
OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25
1118	958	799	639

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F W.B. OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	1020

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

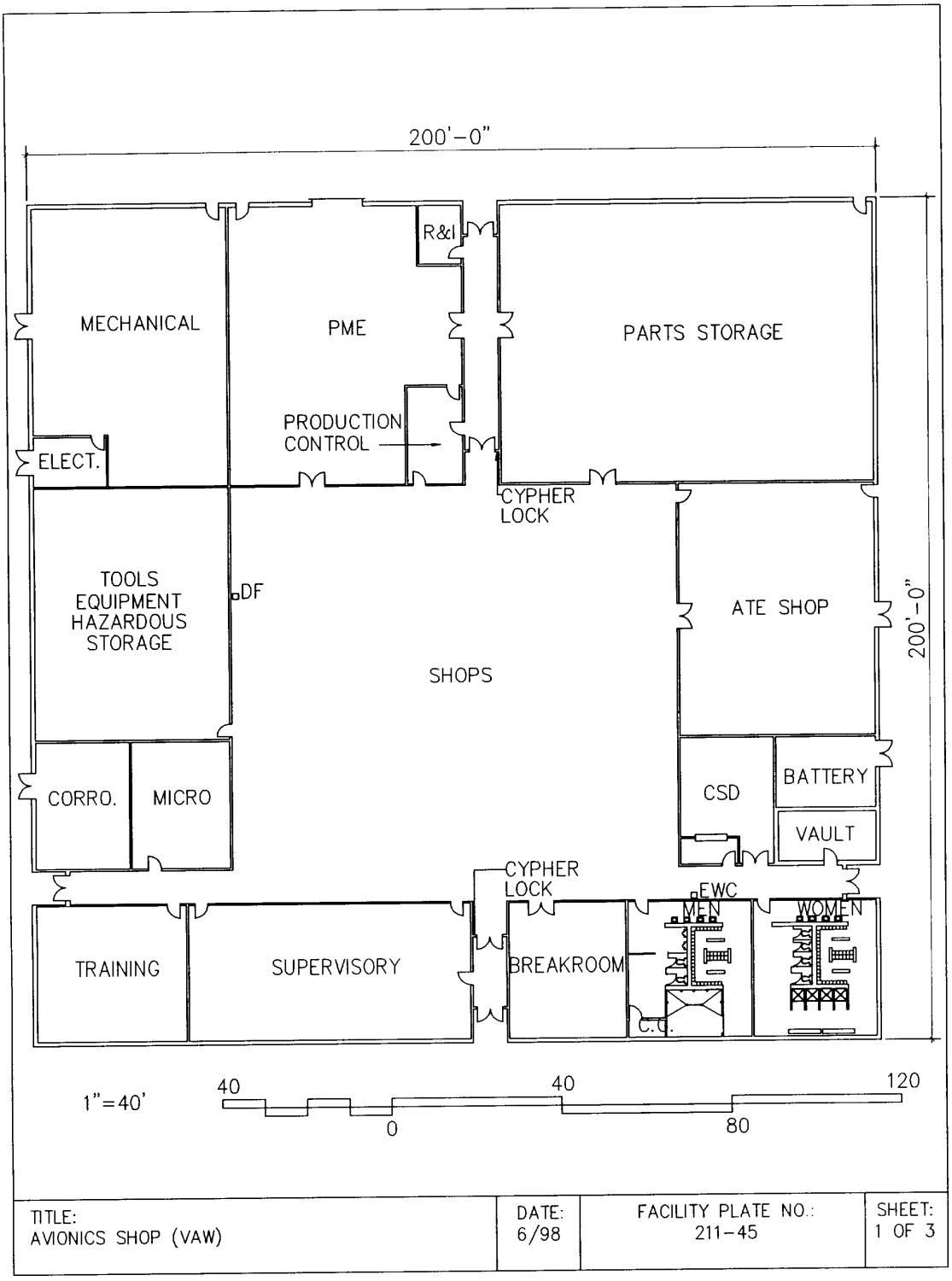
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	217.7
ESTIMATED DEMAND	204.1
POWER	
CONNECTED LOAD	1564.4
ESTIMATED DEMAND	938.4
TOTAL	
CONNECTED LOAD	1782.1
ESTIMATED DEMAND	1142.5
AIR CONDITIONING	121.1

AREAS (SQUARE FEET)

GROSS AREA INCLUDING MECHANICAL EQUIPMENT	68,000

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
AVIONICS SHOP (VS/VP)	12/97	211-45	3 OF 3



TITLE: AVIONICS SHOP (VAW)	DATE: 6/98	FACILITY PLATE NO.: 211-45	SHEET: 1 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	100 G.P.M.
HOT WATER	
RECOVERY RATE (100°F RISE)	100 G.P.H.
STORAGE	100 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)
OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25
671	575	479	383

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F W.B. OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	672

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

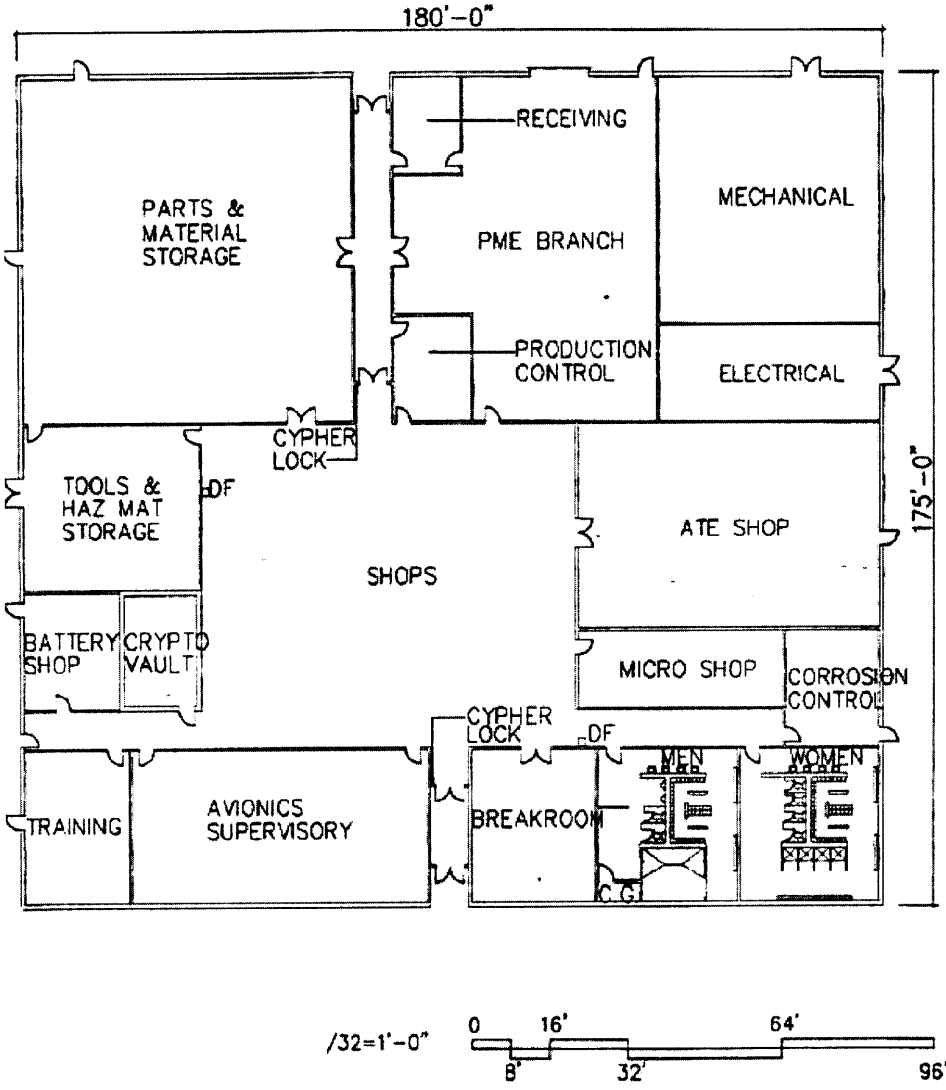
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	127.7
ESTIMATED DEMAND	119.7
POWER	
CONNECTED LOAD	917.9
ESTIMATED DEMAND	550.6
TOTAL	
CONNECTED LOAD	1045.6
ESTIMATED DEMAND	670.3
AIR CONDITIONING	72.7

AREAS (SQUARE FEET)

GROSS AREA INCLUDING MECHANICAL EQUIPMENT	40,000

TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
AVIONICS SHOP (VAW)	12/97	211-45	3 OF 3



TITLE: AVIONICS SHOP (HSI)	DATE: 6/98	FACILITY PLATE NO.: 211-45	SHEET: 1 OF 3

NOTES

PLUMBING REQUIREMENTS

COLD WATER	76 G.P.M.
HOT WATER	
RECOVERY RATE (100°F RISE)	75 G.P.H.
STORAGE	80 GAL.

FIRE PROTECTION REQUIREMENTS NOT INCLUDED

HEATING REQUIREMENTS (MBH)
OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25
535	458	382	305

AIR CONDITIONING REQUIREMENTS

BASED ON 91°F D.B. 76°F W.B. OUTSIDE DESIGN CONDITIONS

COOLING LOAD (MBH)	536

EQUIPMENT AND PARTS UNDER REPAIR NOT INCLUDED

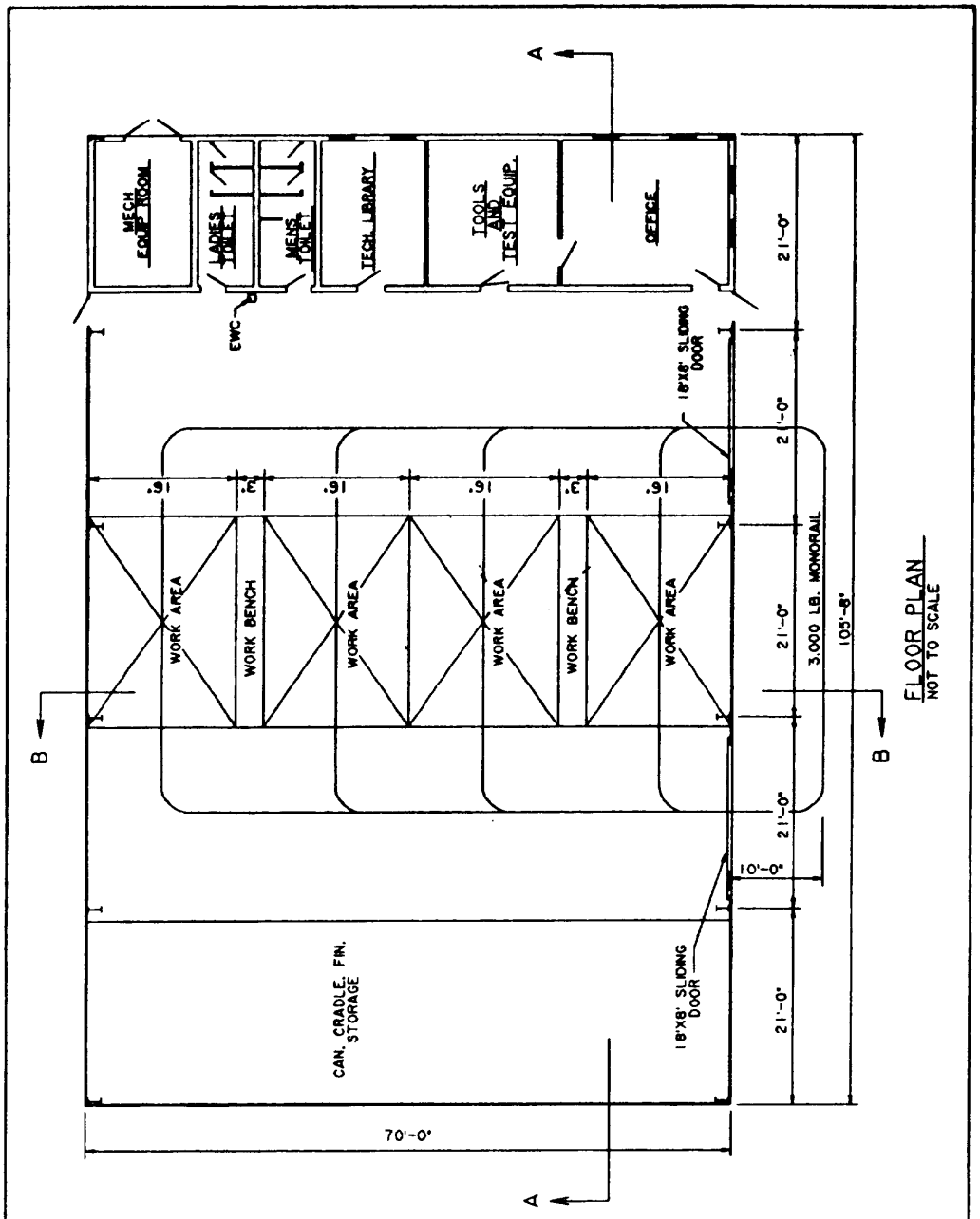
ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	100.8
ESTIMATED DEMAND	94.4
POWER	
CONNECTED LOAD	723.9
ESTIMATED DEMAND	434.3
TOTAL	
CONNECTED LOAD	824.7
ESTIMATED DEMAND	528.7
AIR CONDITIONING	58.1

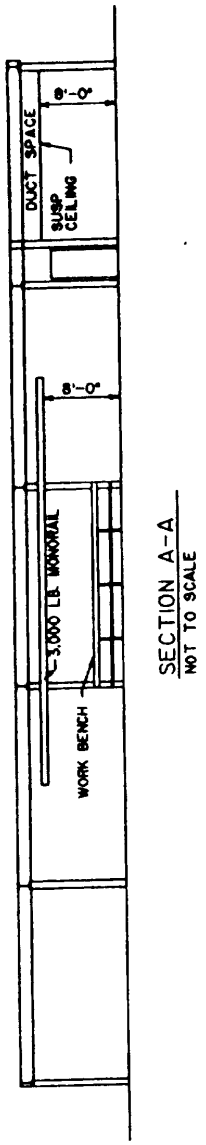
AREAS (SQUARE FEET)

GROSS AREA INCLUDING MECHANICAL EQUIPMENT	31,500

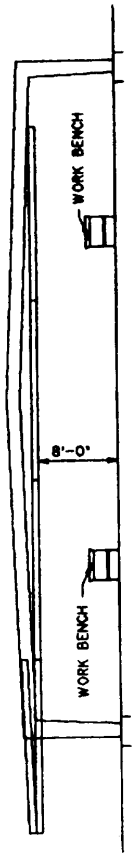
TITLE:	DATE:	FACILITY PLATE NO.:	SHEET:
AVIONICS SHOP (HS)	12/97	211-45	3 OF 3



TITLE: AIR LAUNCHED GUIDED MISSILE SHOP	DATE 03/91	FACILITY PLATE NO. 212-30	SHEET 1 OF 4

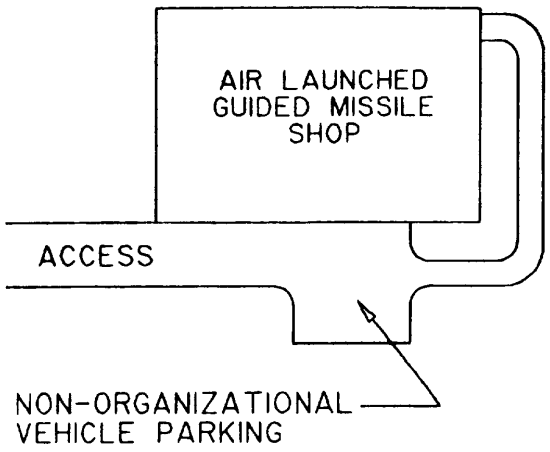


SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE

TITLE: AIR LAUNCHED GUIDED MISSILE SHOP	DATE 03/91	FACILITY PLATE NO. 212-30	SHEET 2 OF 4



TYPICAL SITE PLAN

NOT TO SCALE

TITLE: AIR LAUNCHED GUIDED MISSILE SHOP	DATE 03/91	FACILITY PLATE NO. 212-30	SHEET 3 OF 4

NOTES

PLUMBING REQUIREMENTS

COLD WATER	50 G.P.M.
HOT WATER	
RECOVERY RATE (100° F RISE)	30 G.P.H.
STORAGE	40 GAL.

THE ABOVE RATES DO NOT INCLUDE REQUIREMENTS FOR FIRE PROTECTION

HEATING REQUIREMENTS (MBTU/HR)

OUTSIDE DESIGN TEMPERATURE

-5°F	+5°F	+15°F	+25°F
210	190	162	132

AIR CONDITIONING REQUIREMENTS

COOLING LOAD (MBTU/HR)	40.6

ELECTRICAL REQUIREMENTS (KW)

LIGHTS	
CONNECTED LOAD	35.1
ESTIMATED DEMAND	28.6
POWER	
CONNECTED LOAD	22.2
ESTIMATED DEMAND	19.2
TOTAL	
CONNECTED LOAD	57.3
ESTIMATED DEMAND	47.8
ADDITIONAL DEMAND FOR AIR CONDITIONING	5.9

AREA - SQ. FT. BUILDING

GROSS BUILDING AREA	7,397 S.F.

TITLE:	DATE	FACILITY PLATE NO.	SHEET
AIR LAUNCHED GUIDED MISSILE SHOP	03/91	212-30	4 OF 4

REFERENCES

NOTE: THE FOLLOWING REFERENCED DOCUMENTS FORM A PART OF THIS HANDBOOK TO THE EXTENT SPECIFIED HEREIN. USERS OF THIS HANDBOOK SHOULD REFER TO THE LATEST REVISIONS OF CITED DOCUMENTS UNLESS OTHERWISE DIRECTED.

FEDERAL/MILITARY SPECIFICATIONS, STANDARDS, BULLETINS, HANDBOOKS, NAVFAC GUIDE SPECIFICATIONS, DESIGN MANUALS, AND P-PUBLICATIONS:

Unless otherwise indicated, copies are available from the Defense Printing Service Detachment Office (DPSDO), Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

SPECIFICATIONS

MIL-C-22992	Connector, Plugs and Receptacles, Electrical, Waterproof, Quick Disconnect, Heavy Duty Type.

STANDARDS

MIL-STD-704	Aircraft Electric Power Characteristics.
MIL-STD-1399-300	Interface Standard for Shipboard Systems, Electric Power, Alternating Current.

HANDBOOKS

MIL-HDBK-1000/1	Engineering and Design Criteria and Documentation for Navy Facilities.
MIL-HDBK-1001/1	Basic Architectural Requirements and Design Considerations.
MIL-HDBK-1001/2	Materials and Building Components.
MIL-HDBK-1002/2	Loads.
MIL-HDBK-1003/3	Heating, Ventilating, Air Conditioning, Dehumidifying System.
MIL-HDBK-1003/17	Industrial Ventilation Systems.

MIL-HDBK-1004/1	Preliminary Design Considerations.
MIL-HDBK-1004/4	Electrical Utilization Systems.
MIL-HDBK-1004/5	400-Hertz Medium Voltage Conversion/ Distribution and Low-Voltage Utilization Systems.
MIL-HDBK-1005/8	Domestic Wastewater Control.
MIL-HDBK-1005/9	Industrial and Oily Wastewater Control.
MIL-HDBK-1008C	Fire Protection for Facilities Engineering, Design, and Construction.
MIL-HDBK-1012/3	Telecommunications Premises Distribution Planning, Design, and Estimating.
MIL-HDBK-1013/1	Design Guidelines for Physical Security of Facilities.
MIL-HDBK-1013/11	Instruction for High Security Magazine Door Construction.
MIL-HDBK-1021/2	General Concepts for Airfield Pavement Design.
MIL-HDBK-1021/4	Rigid Pavement Design for Airfields.
MIL-HDBK-1023/1	Airfield Lighting.
MIL-HDBK-1028/5	Environmental Control - Design of Clean Rooms.
MIL-HDBK-1028/6	Aircraft Fixed Point Utility Systems.
MIL-HDBK-1190	Facility Planning and Design Guide.
MIL-HDBK-1195	Radio Frequency Shielded Enclosures.

GUIDE SPECIFICATIONS

NFGS-07410	Metal Roof and Wall Panels.
NFGS-08342	Steel Sliding Hangar Doors.
NFGS-09651	Resilient Tile Flooring.
NFGS-09655	Resilient Sheet Flooring.
NFGS-09656	Resilient Sheet Flooring (Institutional).
NFGS-09680	Carpet.
NFGS-09685	Carpet Tile.
NFGS-13093	Radio Frequency Shielded Enclosures, Demountable Type.
NFGS-13094	Radio Frequency Shielded Enclosures, Welded Type.
NFGS-14535	Monorails With Air Motor Powered Hoist.
NFGS-14637	Cranes, Overhead Electric, Underrunning, (Under 20,000 Pounds).
NFGS-16268	400-Hertz (Hz) Solid State Frequency Converter.
NFGS-16280	Radio Frequency Interference Power Line Filters.

DESIGN MANUALS

DM-1.03	Architectural Acoustics.
DM-3.01	Plumbing Systems.
DM-3.05	Compressed Air and Vacuum Systems.
DM-3.10	Noise and Vibration Control of Mechanical Equipment.
DM-5.04	Pavements.
DM-5.12	Fencing, Gates, and Guard Towers.

DM-22	Petroleum Fuel Facilities.
DM-28.04	General Maintenance Facilities.
DM-38.01	Weight-Handling Equipment.

P-PUBLICATIONS

P-80	Facility Planning Criteria for Navy and Marine Corps Shore Installations.
P-80.3	Airfield Safety Clearances.
P-272, Part 3	Definitive Designs for Marine Corps Facilities.

GOVERNMENT INSTRUCTIONS:

DOD 5200.1R	Information Security Program Regulation.
NAVFAC 11010.44	Shore Facilities Planning Manual.
NAVSUP 4570.23	Navy Precious Metals Program (PMP).
OPNAV 4790.2	The Naval Aviation Maintenance Program (NAMP).
OPNAV 5510.1	Department of the Navy Information and Personnel Security Program Regulation.
OPNAV 5530.14	Department of the Navy Physical Security and Loss Prevention.

OTHER GOVERNMENT DOCUMENTS AND PUBLICATIONS:

AIR FORCE REGULATIONS

AFR-88-15	Criteria and Standards for Air Force Construction

ARMY PUBLICATION

TM 5-805-4	Noise and Vibration Control.

NAVAL AIR (NAVAIR) SYSTEMS COMMAND TECHNICAL MANUALS

01-1A-509	Aircraft Weapons Systems Cleaning and Corrosion Control.
01-1A-512	Design Guide for Avionics Shop Power Distribution.
13-1-6.2	Manual Aviation - Crew Systems Parachutes.

NAVAL SEA (NAVSEA) SYSTEMS COMMAND MANUALS

OP-5	Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation, and Shipping.

(Unless otherwise indicated, copies are available from the Defense Printing Service Detachment Office (DPSDO), Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

Public Law 29 Code of Federal Regulations, Section 1910, Occupational Safety and Health Administration (OSHA)

(Unless otherwise indicated, copies are available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

NON-GOVERNMENT PUBLICATIONS:

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

Industrial Ventilation, a Manual of Recommended Practice.

(Unless otherwise indicated, copies are available from American Conference of Governmental Industrial Hygienists (ACGIH), Committee of Industrial Ventilation, Building D-5, 6500 Glenway, Cincinnati, OH 45211.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1	Emergency Eyewash and Shower Equipment.

(Unless otherwise indicated, copies are available from American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 90	Loadbearing Concrete Masonry Units.
ASTM D 178	Rubber Insulating Matting.
ASTM D 523	Specular Gloss.

(Unless otherwise indicated, copies are available from American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	Minimum Design Loads for Buildings and Other Structures.

(Unless otherwise indicated, copies are available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Drive, Reston, VA 20191-4400.)

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.1	Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

(Unless otherwise indicated, copies are available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), 1791 Tullie Circle N.E., Atlanta, GA 30329-2305.)

FACTORY MUTUAL ENGINEERING CORPORATION (FM)

Approval Guide

(Unless otherwise indicated, copies are available from Factory Mutual Engineering Corporation (FM), 1151 Boston-Providence Turnpike, P. O. Box 688, Norwood, MA 02062.)

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

Lighting Handbook.

(Unless otherwise indicated, copies are available from Illuminating Engineering Society of North America (IESNA), 120 Wall Street, 17th Floor, New York, NY 10005.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	Flammable and Combustible Liquids Code.
NFPA 33	Spray Application Using Flammable or Combustible Materials.
NFPA 70	National Electrical Code (NEC).
NFPA 101	Code for Safety to Life From Fire in Buildings and Structures.
NFPA 409	Aircraft Hangars.
NFPA 780	Installation of Lightning Protection Systems.

(Unless otherwise indicated, copies are available from National Fire Protection Association (NFPA), One Batterymarch Park, P. O. Box 9101, Quincy, MA 02269-9101.)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

Lead Exposure and Design Considerations for Indoor Firing Ranges, Thomas L. Anania and Joseph A. Seta.

(Unless otherwise indicated, copies are available from the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, 200 Independence Avenue, S.W., Washington, DC 20201.)

UNDERWRITERS LABORATORIES INC. (UL)

Building Materials Directory.

(Unless otherwise indicated, copies are available from Underwriters Laboratories Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062.)

GLOSSARY

ACGIH. American Conference of Governmental Industrial Hygienists.

AFFF. Aqueous film-forming foam.

AFR. Air Force regulation.

AIMD. Aircraft intermediate maintenance department.

ANSI. American National Standards Institute.

ASCE. American Society of Civil Engineers.

ASHRAE. American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

ASTM. American Society for Testing and Materials.

ASW. Anti-submarine warfare.

ATE. Automatic test equipment.

CMU. Concrete masonry unit.

CNI. Communications, navigation, and identification.

CRU. Chemically resistant methane.

CSD. Constant speed drive.

DM. Design manual.

ECM. Electronic countermeasure.

EFA. Engineering field activity.

EFD. Engineering field division.

FCA. Field calibration activity.

FRD. Facilities requirement document.

GASSC. Group Aviation Supply Support Center.

GFI. Ground fault interrupt.

GSE. Ground support equipment.

H&MS. Headquarters and maintenance squadron.

HVAC. Heating, ventilating, and air conditioning.

IES. Illuminating Engineering Society of North America.

IMA. Intermediate maintenance activity.

IWTF. Industrial waste treatment facility.

MAD. Magnetic anomaly detection.

MF. Mobile facility.

MIARS. Maintenance Information Automated Retrieval System.

MIL-HDBK. Military handbook.

MMF. Mobile maintenance facility.

MOPP. Master output power panel.

NADEP. Naval aviation depot.

NAMP. Naval Aviation Maintenance Program.

NAVAIR. Naval Air Systems Command.

NAVFACENGCOM. Naval Facilities Engineering Command.

NAVOSH. Naval Occupational Safety and Health.

NDI. Nondestructive inspection.

NFESC. Naval Facilities Engineering Service Center.

NFGS. Naval facilities guide specification.

NFPA. National Fire Protection Association.

NWS. Naval weapons station.

O/I. Organizational and intermediate.

OPNAV. Chief of Naval Operations.

PMB. Plastic media blasting.

PME. Precision measuring equipment.

PMP. Precious Metals Program.

PNC. Preferred noise criteria.

PVC. Polyvinyl chloride.

RFI. Ready for issue.

SACE. Semiautomatic checkout equipment.

UL. Underwriters Laboratories Inc.

UPS. Uninterruptible power supply.

VOC. Volatile organic compound.

CUSTODIAN
NAVY - YD2

PREPARING ACTIVITY
NAVY - YD2

PROJECT NO.
FACR-5007

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2. The submitter of this form must complete blocks 4, 5, 6, and 7.

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3. DOCUMENT TITLE : AIRCRAFT MAINTENANCE FACILITIES

4. NATURE OF CHANGE *(identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

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